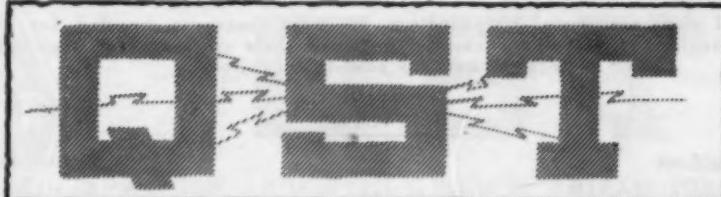


THE OFFICIAL ORGAN OF THE A.R.R.L.



FEBRUARY, 1921.

VOLUME IV

No. 7

CONTENTS

I.C.W. from Sixty-Cycle Current	L. M. Clausing	5
Erratum		6
2ZM's Radiophone and C.W. Transmitter	L. Spangenberg	7
Rotten S.O.L.	The Old Man	9
An Electrolytic Rectifier for C.W.	P. J. Furlong	17
The Washington's Birthday Relay		19
Transatlantic Sending Tests		20
Some Whys, and Speculations as to Some Possible Wherefores	M. B. West	21
Transeon Record Smashed!		23
The Autobiography of a Message	Robert S. Quimby	24
A Simple Wave Meter for Use with Oscillating Circuits	Allen H. Wood, Jr.	25
Amplifying Bulbs	A. E. Harper	27
Editorials		29
The Operating Department		33
Who's Who in Amateur Wireless—Frank Conrad, 8XK		39
With the Affiliated Clubs		40
Amateur Radio Stations		42
"Strays"		46
QST's Directory of Calls		49
Radio Communications by the Amateurs		51
Calls Heard		58

QST is published monthly by The American Radio Relay League, Inc., at Hartford, Conn. Kenneth B. Warner (Secretary, A. R. R. L.), Manager and Editor.

Subscription price, \$2.00 per year, anywhere. Single Copies, 20 Cents.

Entered as second-class matter May 29, 1919, at the post office of Hartford, Connecticut, under the Act of March 3, 1879.

Copyright, 1921, by The American Radio Relay League, Inc.
Title registered at United States Patent Office.

THE AMERICAN RADIO RELAY LEAGUE, Inc.
HARTFORD, CONN.

THE AMERICAN RADIO RELAY LEAGUE

"A national non-commercial organization of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, and for scientific growth."

OFFICERS

President
HIRAM PERCY MAXIM
Hartford, Conn.

Vice President
CHAS. A. SERVICE, JR.
Bala, Pa.

Traffic Manager
F. H. SCHNELL
61 Waverly Bldg.,
Hartford, Conn.

Treasurer
A. A. HEBERT
Nutley, N. J.

Secretary
K. B. WARNER
Hartford, Conn.

DIRECTORS

A. E. BESSEY
Sunnyvale, Calif.

V. F. CAMP
Brightwaters, L. I.

J. M. CLAYTON
Little Rock, Ark.

F. M. CORLETT
Dallas, Tex.

W. T. FRASER
Buffalo, N. Y.

W. T. GRAVELY
Danville, Va.

F. F. HAMILTON
Indianapolis

A. A. HEBERT
Nutley, N. J.

HIRAM PERCY MAXIM
Hartford, Conn.

C. A. SERVICE, JR.
Bala, Pa.

J. O. SMITH
Valley Stream, L. I.

H. L. STANLEY
Babylon, L. I.

C. H. STEWART
St. David's, Pa.

K. B. WARNER
Hartford, Conn.

M. B. WEST
Waukegan, Ill.

F. H. SCHNELL
Hartford, Conn.

H. M. ANTHONY
Muncie, Ind.

OPERATING DEPARTMENT

TRAFFIC MANAGER
F. H. Schnell

ATLANTIC DIVISION
Manager
Chas. H. Stewart
St. David's, Pa.

Asst. Mgr., Central Sec.
John DiBlasi
23 Sinclair Ave.
Flushing, L. I.

Asst. Mgr., Southern Sec.

EAST GULF DIVISION
Manager
E. H. Merritt
192 W. North Ave.
Atlanta, Ga.

CENTRAL DIVISION
Manager
R. H. G. Mathews
1816 Carmen Ave.
Chicago

Assistant Manager
Chas. H. Zeller
4752 N. Maplewood Ave.
Chicago

WEST GULF DIVISION

Manager
Frank M. Corlett,
1101 East Eighth St.
Dallas, Tex.

ALASKAN DIVISION
Manager

ROCKY MOUNTAIN DIV.
Manager
M. S. Andelin
Risfield, Utah

PACIFIC DIVISION
Manager
A. E. Bessey
Sunnyvale, Calif.

Assistant Manager
E. G. Arnold
181 No. 17th St.
San Jose, Calif.

ST. LAWRENCE DIVISION
Manager
Albert J. Lorimer
248 Mackay St.
Montreal, Que.

ONTARIO DIVISION
Manager
A. H. Keith Russell
358 Markham St.
Toronto, Ont.

NEW ENGLAND DIVISION

Manager
Guy R. Entwistle
137 Sutherland Road
Brookline, Mass.

ROANOKE DIVISION

Manager
W. T. Gravely
854 Main St.
Danville, Va.

DELTA DIVISION
Manager
John M. Clayton
1301 Welch St.
Little Rock, Ark.

MIDWEST DIVISION

Manager
L. A. Benson
4942 Wiesehan Ave.
St. Louis

DAKOTA DIVISION
Manager
Boyd Phelps
416 Court House
Minneapolis, Minn.

NORTHWESTERN DIV.

Manager
John D. Hertz
P. O. Box 2089
Portland, Ore.

ADVISORY TECHNICAL COMMITTEE

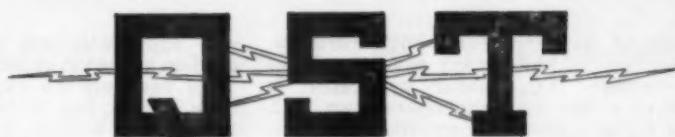
C. S. BALLANTINE
WM. C. BALLARD, Jr.
LEROY M. E. CLAUSING
FRANK CONRAD

MINTON CRONKHITE
J. H. DELLINGER
C. L. FARRAND
PAUL F. GODLEY
LEO C. YOUNG

L. A. HAZELTINE
C. D. TUSKA
R. H. G. MATHEWS
J. O. SMITH

Address General Correspondence to Executive Headquarters, Hartford, Conn.

FEB 19 1921



A Magazine Devoted Exclusively to Amateur Radio

I. C. W. from Sixty-Cycle Current

A Method for Obtaining Radio Frequencies, Completely Modulated at a Musical Frequency, with an Electron Tube Supplied from a Sixty Cycle Source.

By L. M. Clausing*

It is often impossible or inconvenient to obtain the high voltage D.C. or the high voltage 500 cycle A.C. required for the plate supply of transmitting tubes. The method about to be described will eliminate this difficulty where 60 cycle A.C. is available.

When alternating current is supplied to the plate of an electron tube to which an oscillating circuit is attached, one half of each cycle is transformed into radio frequency currents, and this radio frequency is therefore modulated completely at a frequency equal to the supply frequency. Commercial frequencies below 133 cycles cannot be used effectively for this purpose because the note obtained is very low and the signals are hard to copy through static.

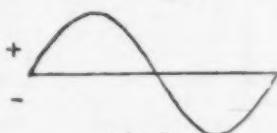


Fig. 1

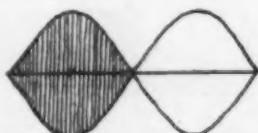


Fig. 3

By introducing a suitable current reverser in the alternating high voltage supply it is possible to reverse the alter-

* U.S. Naval Radio Research Laboratory, Bureau of Standards, and member of the A.R.R.L. Advisory Technical Committee.

nating current periodically at any desired frequency. This is shown in Fig. 2.

Fig. 3 illustrates the envelope of one cycle (frequency 60), converted into radio frequencies by means of one vacuum tube.

Fig. 4 illustrates the envelopes of one cycle (frequency 60), reversed so that 480

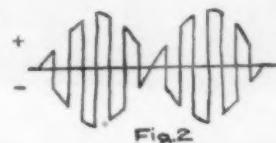


Fig. 2



Fig. 4.

cycles are produced, converted into radio frequencies by means of one vacuum tube. A single glance at Fig. 4 will probably leave the impression that anything but a musical note will be obtained with such large variations in amplitude, but on second thought it will be seen that the amplitude of the envelopes varies similarly to those obtained from a non-synchronous spark set. An actual test has shown that the tone is very much like that of a non-synchronous spark set.

The addition of a transformer and such a rotary reverser will transform ANY TUBE SET into a universal interrupted continuous wave set which can be used equally well on A.C. or D.C. if the motor

is designed to operate on both currents. It is of course understood that the usual high voltage D.C. motor generator is necessary if the set is to operate on D.C.

The signals from an experimental set, operated on 60 cycles, tuned as sharply as those from any interrupted continuous wave set.

Any scheme for reversing the high voltage current at high speed can be employed with this system. Arcing at the brushes can be prevented by shunting a condenser across the source.

gap and stationary spark electrodes are used in place of brushes.

So far only an experimental outfit has been tested but it is hoped that further refinements will be possible when another set is constructed.

Editor's Note.—This is a real good idea for the origin of which we are grateful to Mr. Clausing. If we are going to use A.C. on the plates some scheme is necessary where the tone for I.C.W. telegraphy can be improved over the lighting frequencies.

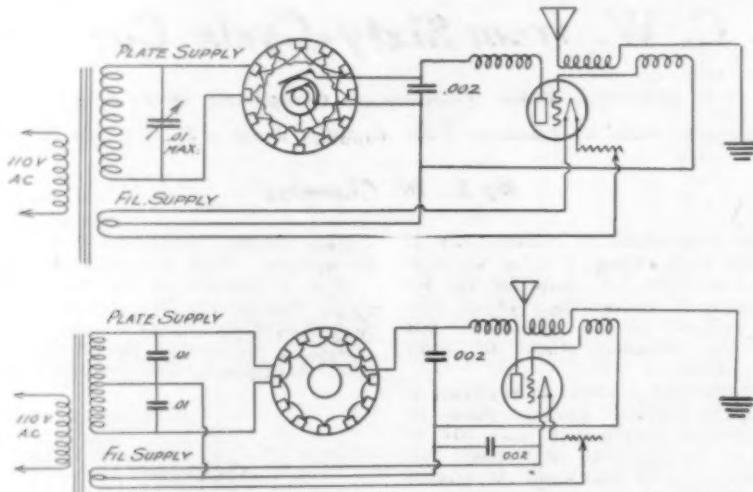


FIG. 5

Fig. 5 shows two methods of connecting this system to a Meissner oscillating circuit. The rotating reverser as shown above will reverse current for small tube sets operating on less than 1000 volts with ease if the spacing between the contacts on the rotating disk is over $\frac{1}{8}$ of an inch and the brush width is not over 1/10 of an inch.

Our best idea to date has been to use double the number of tubes so as to employ both sides of the wave, and then modulate the output by buzzer or chopper—not a very simple scheme. Mr. Clausing's method should entirely answer the problem.

The construction of the rotating reverser should not be difficult—a Bakelite disc four or five inches in diameter, $\frac{1}{8}$ or $\frac{1}{4}$ inch thick, with segments inserted commutation fashion and alternate ones connected. A diameter of 4.77 inches, for example, provides a periphery which will accommodate 12 segments $\frac{1}{4}$ inch wide, with 1 inch space between segments.

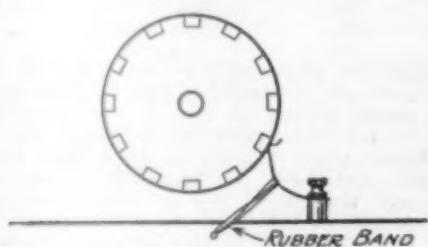


FIG. 6

Phosphor-bronze brushes shaped as shown in Fig. 6 with a rubber band for damping vibrations have proven satisfactory.

Higher voltages can be reversed for large tubes if the rotor is constructed similar to the rotor of an ordinary spark

ERRATUM
On page 32 of our January issue, under the heading "A Bad Situation", the Bureau of Standards is reported as having advised us that in their opinion there were more unlicensed transmitters in the cities of Cleveland and Philadelphia than there were licensed. This statement on our part was in error. The reports relative to interference in these cities were received from individual recorders, not from the Bureau of Standards. We are sorry for the error.

2ZM's Radiophone and C.W. Transmitter

By L. Spangenberg

Presented at Meeting of Radio Club of America, Columbia University,
May 28, 1920.

THE following is a brief description of a Radiophone and C.W. Transmitter which was constructed by the writer and which has been in use for the past four months at his station on an antenna having a fairly low resistance and a natural period of 250 meters, with quite satisfactory results.

An attempt has been made to show the design of this set by photographs, Fig. 1, 2, and 3, which together with the wiring diagrams and cuts, I believe will show same quite clearly.

It was found that for phone or buzzer transmission using two tubes as oscillators, only one tube was needed as a modulator to give almost perfect modulation, although the set is arranged to use two tubes as modulators if found necessary. It is also so arranged that all four or part may be used in parallel as oscillators for C.W. Transmission.

The antenna current on different stages of transmission is as follows: Radiophone and Buzzer Transmission using two tubes as oscillators, with all circuits properly adjusted, six-tenths ampere; when using all tubes as oscillators for C.W. Transmission, an antenna current of 1.5 amperes may be

longer, still better. The set has a range of from 200 to 425 meters.

The bakelite panel on which the meters and different parts are mounted is 12" x 12" x $\frac{1}{4}$ " and fastened to a wooden base 12" x 8" x $\frac{3}{8}$ ", well seasoned, and braced to panel as shown in Fig. 2 and 3. It will be noticed that almost all of the parts are of a standard make and may be

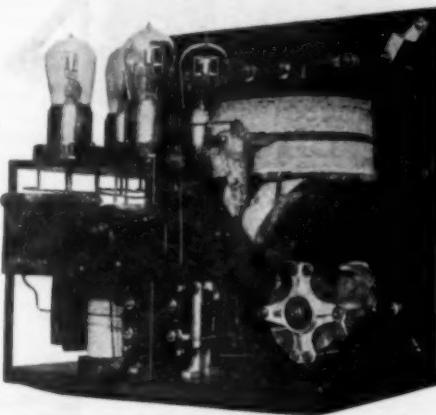


Fig. 2



Fig. 1

obtained. The wave length used when the above results were obtained was 325 meters, that being one of the wave lengths called for in station license, but may add that on shorter wave lengths almost the same results can be obtained and on

purchased from any supply house handling radio equipment.

The schematic wiring diagram, Fig. 4, shows the circuit used and a simple way of changing to radiophone, buzzer or C.W. transmission by the means of a DPDT switch, with the aid of a SPDT switch to change from radiophone to buzzer transmission while the DPDT switch is in the first position. The diagrammatic wiring plan, Fig. 5, shows the actual circuit of this set, using a standard make of five-contact drum switch which replaces the DPDT switch and performs other duties, such as closing the filament circuit, high voltage circuit, and changing the antenna from sending to receiving, also having a neutral position for all circuits. By using this type of switch the operator can very readily change to any type of transmission, and then back to the receiving position, at the same time opening both the filament and high voltage circuits.

The rheostat regulating the filament current may be of a standard make, but when using four tubes (the current being too heavy for the wire) it was found necessary to divide the resistance, making

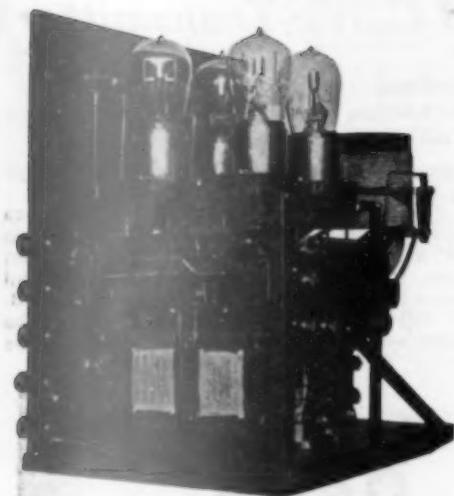


Fig. 3

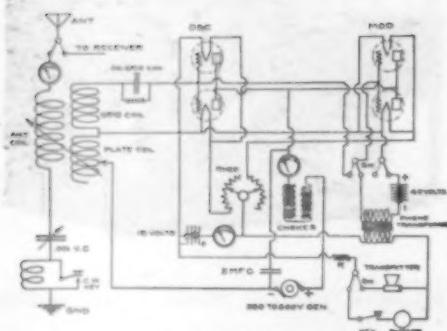


Fig. 4

two variable resistances, one for the two oscillator tubes and one for the two modulator tubes, as shown in the wiring diagrams, adjustable independent of each other (by the double-knob control located in lower right hand corner of the panel, Fig. 1.—Ed.)

The filter arrangement using two coils and two $\frac{1}{4}$ mfd. condensers is shown in Fig. 7 and is self explanatory.

The Inductance is shown quite clearly in Fig. 6 and may be mounted on back of panel as shown in photographs. (Note: The inductance forms are circular in cross-section, not oval.—Ed.)

The microphone transformer is a standard make of the closed-core type and works quite satisfactorily.

It will be noticed that a C battery of about 40 volts is used as a biasing battery in the grid circuit of the modulating tubes as shown in the wiring diagram.

The type of tubes used is the well known VT-14 and on which the above results were obtained. By using the VT-2 type of tubes, 25 percent better radiation may be obtained on all kinds of transmission.

The plate voltage is obtained from a $\frac{1}{4}$ H.P. 110 v. A.C.—500 v. D.C. motor-generator, and the proper voltage required obtained by placing an adjustable rheostat in the field circuit—350 volts being the voltage used at all times.

The filament current is supplied from a 12-volt storage battery and regulated by the filament rheostats.

The microphone transmitter is an essential part of the outfit and the best that can be obtained should be used; that is, wherein the resistance is varied with the voice very

(Concluded on page 23)

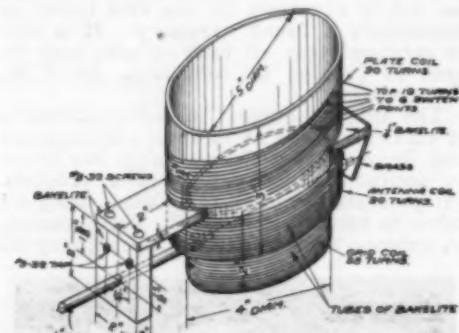


Fig. 6

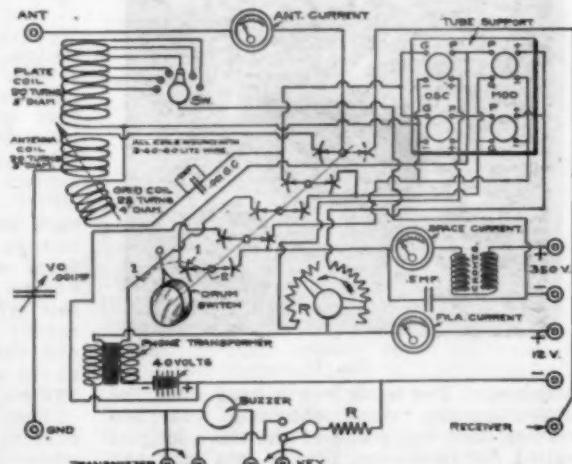


Fig. 5



Rotten S. O. L.

By The Old Man

Don't dare to miss reading this. T.O.M. loses his grouch and at our special request reports the Midwest Convention. Here is all the news. And if you, gentle reader, come under the classification described in this story, get wise to the moral thereof and save up your berries—for the First A.R.R.L. National Convention in Chicago next September!—Editor.

THAT'S what it is, you stay-at-homes. You are sure out of luck. You missed the biggest thing that ever came down the radio pike. That's what the A.R.R.L. Midwest Convention at St. Louis was. I had the best daggone time I have enjoyed since a certain little affair down in Cincinnati, when I was young and frolicsome, and a certain somebody lost seventy-five percent of a perfectly good right ear.

Matty himself said it beat the Chicago Convention, and by all accounts that was a good one. Yes sir, she was some show, and The Old Chief was pretty near getting it right when he said, in his good-bye speech the last night, that the St. Louis Convention marked the high water of Amateur Radio. The darned thing set me back the price of a new Dubilier condenser, capacity naught one, twenty-five thousand volts, my greatest want; but it was worth it. I accept with pleasure our Editor's request to report the business.

I never went to a Radio Convention before, and I was not certain what you did at one. Living out in the bush, all I know is Radio Club meetings. I walked into the Hotel Statler that first evening

with considerable hesitation. It's a whale of a place, and there were a slew of folks standing around in the gilded lobby. I thought every one in the hotel was a radio man, and as they appeared to be a pretty pert looking lot, my feet cooled off considerably. I milled around carefully for a spell and finally discovered that everybody



Schnell, Corlett,
Hamilton and Stewart
having a Hamfest.

was not a radio bug, but that the A.R.R.L. end of the business centered around a little veiled lady sitting at a desk with a lot of blue badges. I hung around awhile to see what you were supposed to do, and in a few minutes some of the kind I know all about came around, gave their names and call letters, deposited a five-spot and were given a blue badge. This looked easy, and having the five-spot and a little to spare besides my tickets home, I sailed up, dropped my spot, gave my dope and got my badge. With this on my front, I felt I looked like a million dollars, and wasn't afraid of anybody, from a bellhop up.

The program said they were going to pull off something on the seventeenth floor. Seeing the blue badges all going into elevators, I joined in and boarded one. Back in our town all the buildings are not seventeen stories high. Hence, when the elevator girl slammed on the hoisting gear, I was not prepared. The outfit went off



so daggone sudden it blamed near sat me down. Talk about acceleration and oscillation! This elevator had every thing beat I ever got aboard of. Like a chump, I never thought that if they start up quickly, they probably will also stop quickly, so about the time I got my knees back straight and my hat reassembled on me,



I A W heard QSA
in St. Louis.

the girl jammed on the brakes and—u-u-u-up came everything. Nothing inside of me failed to respond. Every last thing fetched away and rose up. What between my supper, my internal affairs, and the decrement of that oscillatory stop, I was busy trying to swallow things. In the middle of operations we landed at Nr. 17, some doors shot open, and we were deposited plump into the middle of a mob of radio bugs all wearing blue badges, and all shaking hands and all smoking cigarettes fit to bust. Before I had time to catch my breath, somebody grabbed me by the arm and looking around, I found myself gazing into the smiling face of Mr. K. B. Warner, Editor of QST, Secretary of the A.R.R.L. and all around good fellow.

I recognized Warner right away from his picture in QST, and darned if it didn't seem as though we had always known each other. That's the funny thing about these Radio Conventions. You get to know folks intimately in five minutes time. Warner whispered a few whisks on a confidential matter and we were getting along fine, when a keen-eyed, alert young chap with something evidently heavy on his mind, pushed through the crowd headed for Warner. In less time than it takes to tell it, I was shaking hands with the redoubtable Bill Woods—Benwood Bill—the liveliest wire in Amateur Radio. Just think! Have been hearing his signals and reading about him for years, and here we were shaking hands and looking into each other's smiling faces.

Bill was busy as blazes. He had the whole blamed Convention on him. He had something urgent with Warner, and the two left in a minute. Before I had time

to get straightened around, the crazy elevator behind me exploded again, and another bunch was disgorged into the room. I gasped for air when I realized that the gray-haired middle-aged man who came out first was no other than our President, Mr. Hiram Percy Maxim. By the Great Horn Spoon! Right here in the same room! Had known him for years and years, it seemed like. Had written him no end. The Old Chief, himself! Say boys, it was just the greatest feeling that came over me that I have had in many a long year. It just grips you. I looked for Tuska, the other old-timer, but could not find a face that filled the bill. He did not come, daggone him. He ought to be ashamed of himself. We all would have given a good deal to have had a look at him and a shake of his fist. But that will be one of the treats of some coming Convention. We all have a warm spot in our hearts for that boy Tuska.

I sure did want to shake the fist of The Old Chief, so, edging up, I introduced myself. He gave me one swift, sharp look straight in the eye, and then we shook. Say, you fellows, it was worth the whole darned trip. We laughed and nudged each other like a couple of kids. Gosh, I never had such a wonderful few minutes. The Old Chief and I have several good jokes between us which are not for publication. We whispered and laughed and were right in the thick of the daggondest best time you can imagine when somebody pushed up and I was introduced to a bald-headed gent I certainly ought to have known. I got the name "West", but it did not sink in until his call letters came through. Old 8AEZ! For the love of Michael Angelo! West, of Lima. West, the fellow with the loudest, cleanest, sharpest and nearest-to-200-meters spark of pre-war days. Actually shaking hands with him! We were having a great time of it when somebody asked me to shake with another one, and bust my garters if it wasn't Prof. Candler of St. Mary's, old 8NH, recently



8ER, and now 8ZL. Well! well! so this was the owner of the big noise over in the western part of the State! Say, boys, he looks like his picture. But you would never in the world suppose by his looks that he can roar as loud as we hear him every night. Of course the next question was, where is Mrs. 8ZL? Had not come. Rotten SOL. Too bad. Wanted to see her specially. Another old timer for some future Convention. Won't she make a hit the first time she gets up and makes a speech before a Radio Convention! The lady has something coming to her, you hear me.

The Professor and I chatted a minute and all kinds of familiar call letters passed by. I saw 8ZA, 9AU, 9AO, 5ZP, 5IP, 5YH, 4BZ, 9PY, 7YS, 80J, 8ZZ, 9EL, 9CS, 5AE, and look at the badge on the tall fellow! 9ZN—Matty, himself. Why man, here within these four walls was the greatest galaxy of radio talent ever gathered in the history of human affairs. To miss such a thing is like missing being born at all. I simply had to shake with Matty, so I squirmed through and in a moment we were at it. He told me how I came in at Chicago, and I darned near kissed him. How you do love to hear



Inside Dope: 8ZL is interested in astronomy—guess trying to find out if 8ZL is heard on Mars or the moon.

somebody tell you that your signals are QSA. If Matty spoke the gospel, I guess Old Betsy is not so rotten.

Support me! 9CP! Do you mean to tell me that child is 9CP? Well, if that don't yank the bun off the shelf! Say, you chaps who never get away from the front porch (and this applies to Marion), the owner of that spark we hear signing 9CP is a lad in short trousers. That's what, and you have to go to Conventions to find these things out. 9CP was only one, and before I finish with this yarn, I will tell you something more about youth which will knock your eye out worse than this.

So, that is 9ZJ, over there talking with Mr. West! 9ZJ has that beautiful tone that we have all wondered about. He is Mr. Hamilton of Indianapolis, one of our

A.R.R.L. Directors. You don't mean it!—Is that Godley! Paul Godley, designer of the famous Paragon, the best tuner ever built for short wave work? Some distinguished company, I'll tell the world. I am told that this Godley person probably knows more about short wave receiving efficiency than any living man. And right here in the room with us! What's that, 8IB? I've seen that call before. Fine looking young fellow. And look at the

Matty and the gang there from Chicago.



Third District gentleman. Who is he? Mr. Stewart, 3ZS, from Philadelphia, and another A.R.R.L. Director as well as legislation expert. And who is the husky with the Fifth District call? Corlett, still another A.R.R.L. Director, and all the way from Dallas, Texas. That is some business, fellows, coming all the way from Texas. Think of it, you rocking chair experts, 5ZC right here in the room with us. I hear him every time he touches his key, but I never expected in gawdsword to meet him.

About this time Benwood Bill fell upon the desk with a heavy mallet and made conversation difficult with his QRM, so we all took seats. Mr. Benson, the Division Manager of the Midwest Division, took command of the meeting and after a neat spiel, introduced Mr. Woods as the permanent chairman. Benwood Bill delivered an oration that made you wonder why he never ran for office and then called upon the Midwest Division officers and the prominent A.R.R.L. officers and directors. It was simply great to see these well known people and hear them talk. All of us had heard of every one of them, and it certainly was a great occasion to listen to them. Benwood Bill called upon anybody his fancy lighted upon, and it made no difference whether you had a speech or were tongue-tied, or were free, white or twenty-one or not, you simply had to get up and orate. This takes nerve from most of us, but Bill has no ideas on this matter of nerve. He just goes crashing on regardless. He was just starting to lead a new

innocent to the slaughter when a feminine voice, in trouble, was heard signalling S.O.S. on a broad wave, and somewhere off to the southeast. Naturally everybody rubbered to see what had busted loose. She had evidently been hove out of the elevator and had got lost, and here she was yapping



Power-Factor-and-
Gap West.

for help. She seemed to want her husband, or somebody else who would kindly take his place. It seemed so entirely out of harmony, not to speak of resonance, for a young woman to be telling her domestic troubles at a radio meeting that everybody began to wonder whatell. I could not believe what I was hearing. She put on full power when she let go her third yap, and that brought the chivalrous ones to their feet. Mr. Forshey and Mr. Godley, who evidently had ideas about the when-knighthood-was-in-flower business, gracefully arose and went forward to offer their kindly services to the troubled lady. You could see all sorts of romantic possibilities from these two gallants. But, 'twas not to be. A male voice, over in the center of the room, arose and knocked the ding-busted pudding out of the romance. Evidently it was hubby. He did not appear to be possessed of any romance at all. Instead of gracefully floating over to the beautiful lady and reasoning with her about talking so loudly in public, he turned in his seat and told Mame to go on back downstairs and sit down and wait. He was busy learning about radio. She gave him a pain in the neck, always butting into his radio interests.

Instead of calming Mame down, this caused Mame to blow up for fair. She nearly knocked the romantic Forshey and Godley down, made a rush for hubby, and grabbing him, started to mop up the floor with him. She had evidently lost her patience completely, and did not care whether she found it again or not. She let it be known that she had little or no use for radio or radio people, and she was for getting hubby home even if she had to beat him into insensibility and crate

him up and ship him by express to do it. She was a determined little person.

He broke away and I'll be darned if they didn't start a foot race in and around the chairs and aisles. By this time, the whole daggone meeting was in an uproar. Everybody forgot radio and some of the more joyous ones had difficulty in keeping out of the game themselves. It began to look as though a real old-fashioned rough house was in the making, and that somebody better begin thinking about calling the police, when these two joined hands and gaily skipped out through a rear door. Benwood Bill whaled the desk for order, and never cracking a smile, and acting for all the world as though this little episode was nothing in a busy man's life, remarked that the QRM seemed to have subsided, so we would go on with the meeting. Forshey and Godley went into hysterics, and the rest of us went on with the meeting.

Editor Warner gave us a scolding about not obeying the law better. He asked how many of us in the room were really obeying the radio law as to wave length, wave purity and decrement. He wanted the law-abiders to stand up. A man with both arms cut off at the elbows could have counted the law-abiders on the fingers of one hand. Warner told us we ought to reform, and practice what we preached. He is right, and this meeting will do a lot of good. I know I for one am going to fix certain things up and if anybody knows where a respectable decremometer of moderate age can be secured at reduced price, will they please communicate. Intentions are strictly honorable.

Traffic Manager Schnell was dragged out along about here to give us a talk about message traffic, and he advocated cutting out the greetings-by-radio business



"Paragon Paul"
Godley.

and getting down to brass tacks in our messages. It is good advice, but how we are going to get this uplift stuff across to the young things who write out the messages on a sheet of perfumed paper gets me. Schnell did not advise how to

transmit the perfume along with the message, which is something that needs attention from some of the experts.

A Mr. Haddaway was then requested to step forward and spiel a few. The gentleman not being in the hall, a Mr. O'Neil offered to speak for Mr. Haddaway. It seemed that Mr. O'Neil had been out to Mr. Haddaway's house. He explained that

He said when Mr. Haddaway burned out a bulb he simply went down into the kitchen and built himself a new one. It was nothing to him to burn out a bulb. During the evening, if the signals did not suit him, he went down stairs and made a new bulb to suit the weather. Going some, strikes me. You have to go to Radio Conventions to find these things.

The next evening we had a look at Mr. Haddaway, and listened to a well delivered speech by him. He is a good looking lad with the appearance of a scholar and a reader. Some day he will be a radio engineer, and Amateur Radio, the city of St. Louis and the United States of America will be very proud of him. Mr. Maxim in his remarks at the close of the technical session said that it had been a great honor to have been present at the same meeting with Mr. Haddaway, radio engineer of St. Louis, Mo., aged seventeen.

Legislation and the bill now pending in the Senate then came up for a go. Benwood Bill took the gloves off and handed the bill a few. Mr. Stewart, the League's expert on these matters, was called upon and he told about the situation and how if the bill becomes law it will give into the hands of a commission the power to change our wave lengths three times a day if anybody on the commission feels so inclined. Mr. Stewart says the bill gives no opportunity to be heard except as to how hard they will soak you in the way of a penalty and what kind of a license you may have. There seemed to be several other little jokers in the bill which would make Amateur Radio dependent upon how some official at Washington happened to digest his breakfast.

Bill was chock full of fight on the subject and was for doing something violent and doing it soon. After some discussion, a committee was appointed to draw up a set of resolutions to be sent to the Naval Affairs Committee at Washington, and which would convey to them the esteem we held them in. This was done the next day, and seventeen telegrams were sent, one to each member of the Senate Committee on Naval Affairs at Washington, and so worded that between the lines it was seen that the amateurs of the country desired and hoped that each member of the Committee would choke to death at his early convenience.

A collection was taken up to defray the expense of the telegrams and any funeral incidentals that might be entailed. This matter is evidently a serious one, and if any of you stick-in-the-muds on the front porch have not yet written your Senators, for the love of Mike come out of your trance and get up enough pep to borrow a fountain pen. As Benwood Bill says, "DO SOMETHING BESIDES SLEEP".



Does anybody remember who sat at the northwest corner of the platform at the banquet?

Mr. Haddaway was a gentleman of the advanced age of seventeen, had a radio station, and in this radio station he had a spark transmitter, a C.W. transmitter, and a radio telephone, all of which he had "built himself". We hear so much of this "built himself" stuff that we choke at it mostly. In Haddaway's case, there was nothing to choke at. Haddaway really had built everything himself. He had to or he would not have been able to get it. By everything, Mr. O'Neil said he meant EVERYTHING. He meant storage batteries, B batteries, telephone transmitters, amplifying transformers, chokes, filters, condensers, and BULBS. Yes indeed, BULBS! The only thing he did not make was a pair of pliers. He bought these.

What do you think of a lad of seventeen who makes his own bulbs, soft and hard, for detector and amplifiers? Makes his own grids, filaments, and plates, pumps his own vacuum, and by heck, builds his own vacuum pump to pump his own vacuum. Mr. O'Neil said he tried some of these bulbs at his station, and found them better than a good many he had bought.

The next night was even better than the first one. A blackboard had been set up and several of the best known radio men in the country discussed things ranging from aerials and grounds to decremeters. A lot of new faces appeared, including a very ruddy and smiling one attached to the upper end of a big man, known on the West Coast as Mr. A. E. Bessey, A.R.R.L. Division Manager, Pacific Coast Division. Mr. Bessey had come all the way from San Francisco, and he was given an appropriate welcome, part of which was three rousing cheers. He made the representative from the Sixth District and it was said that that



"Sunny Jim"
Bessey from
Sunnyvale.

completed the list, and for the first time in Amateur Radio history, representatives from all nine Districts were present.

Mr. Bessey told us about the way the amateurs on the west coast feel when it is suggested that we break up into a lot of little leagues instead of one, big, national A.R.R.L. It only shows the strength that we have.

Then Mr. Paul Godley of New York talked to us for an hour. I think he gave me more points than I ever got in the same length of time before. I could have listened to that man talk all night long. He can draw audion circuits blind-folded with both hands tied behind him. He sees the little electrons chasing each other through the circuits just as though every one carried an automobile marker. I learned more about running a receiving tuner than I ever knew before, and it is my guess that several others followed suit. Mr. Godley advises against monkeying with the knobs until you have thought out what you want to do. It is good advice all right, but I can see some of these Eighth District galoots thinking about the moves before they make them—NOT. It is their system to try everything. After listening to Mr. Godley, it is my notion that about one amateur in one thousand knows what takes place when you change the inductance or the capacity values or the coupling in a

regenerative tuner. I will bet an E.I. cat-whisker detector that there is not one in ten thousand who knows what takes place inside a vacuum tube.

After Mr. Godley finished, Mr. Benson asked for recognition from the floor. Benwood Bill consented to recognize him, and Mr. Benson then explained that some kind of a nut was without and wanted to show a new STATIC ELIMINATOR. While he was speaking, the nut walked in and wheeled a hand truck carrying a crate down the center aisle, and unloaded it in front of the platform. Bill did not cotton to the notion. He bucked. He asked questions regarding the static eliminator person which were bordering on the personal, and remarked in very firm language that it was all right for any manufacturer of radio apparatus to seek to demonstrate his junk, and probably many of the members would no doubt like to see it, but just the same for a man to butt into a meeting without first securing permission got his goat. The more he talked, the madder and more oratorical he became. Seemed like Bill was going to spill over and somebody with a hand truck and a static eliminator would be bounced in a few minutes. Then somebody else suggested that as the machine was here in the room and ready, the members better see the demonstration. By this time, I began to think I was going crazy again, and this made me suspect there was something phoney getting ready to be pulled. Then somebody else suggested that Mr. Maxim open the crate. Then it was certain there was something doing. The Old Chief had his suspicions also, for he approached the mysterious box cautiously. He had just laid his hand on the blamed thing when it busted open, and young lady dressed for anything but winter weather hopped out. She started to sing and was for perching on The Old Chief's shoulder by the look of things, but was satisfied with hugging him. Then she circled around, singing something to the effect that she was loving somebody or something terrible hard, but was not getting any satisfaction. She tried to get a crumb of sympathy from a gent with a Fifth District badge and a military uniform on him, but it was ND. Then the damsel gave a squeal and disappeared off through the back door. The gang roared and Benwood Bill was seen to concede one slightly used smile. After things quieted down, he remarked that now that the Static Eliminator had been eliminated, we would go on with the Convention.

Young Mr. Haddaway was around this time, evidently to hear the technical talks, and it was then that he made the speech referred to earlier in this report. Left stranded on a desert island in the middle of the Pacific Ocean, I have no doubt that

this young man Haddaway would have a 500 KW set in operation inside of forty-eight hours, if he only had a pair of pliers to start with.

Mr. West took a crack next and gave us a fine talk on what happens in a rotary gap. He showed how much more could be obtained than we now get if we would reduce certain losses, which were easy to reduce. He is another almighty interesting talker. He knows his story and it certainly gets under your belt to hear him point out the possibilities that are lying right there at your hand. He told about how a well behaved condenser saves up its money and then spends it all in one grand and glorious bang, and he showed how quickly the rotary gap must come up and make its getaway, if it is to linger only long enough to permit one dozen oscillations in the closed circuit. It seemed that a gap must rotate at a trifle like 150,000 revolutions per minute. Several young men took copious notes at this juncture. They evidently intended to put a larger pulley on the motor when they got back home. It will only take something like a forty-foot pulley on the motor and a half inch pulley on the rotary.

I was sorry Mr. West neglected to tell us something about old 8AEZ. In the happy days of long ago, his spark was a peach. We all would have liked to have heard him tell how he did it. Gosh, how this hope of getting long distance does grip you. It is just like when you tear off eighteen or nineteen messages in series of five or so, and every time the other fellow comes back with a snappy and solitary R and GA. Once in a long while we hook into somebody who can do this and we get locked together and everything seems to go one hundred per cent perfect. Just good clean sending and good clean receiving and not one single superfluous signal. Mr. West makes you feel like you do when you pull one of these stunts.

He mentioned fading and NAJ, and one of his listeners got interested to the extent of telling him that NAJ had the swingest signals ever he heard come out of any radio station. Prof. Candler blamed this on the Northern Lights, and sun spots, and things in general. Mr. Miller, of the Jewell Instrument Company blamed it on the way the amateurs handle their voltmeters and milliammeters. He says that while these instruments are designed to stand service, nevertheless they should not be used to peg at the cat. They work better if they are kept on the table permanently and not dropped on a cement floor. Mr. Miller does not favorably recommend dropping instruments around.

At the end, Mr. Maxim was called upon to polish off the evening with few well chosen brick bats, and to summarize what

the speakers had said. Holy smoke, thinks I, that is some nice little chore. Suppose I were called upon to get up and undertake that job. After considering the heft of the different speakers of the evening, I allowed that I would rather he had the job. He got away with it, pointing out the desirability of amateurs trying to do better jobs in their stations. He criticised the usual amateur procedure of starting out to build a radio station at two thirty with the idea of having it ready to use at six. That hit me. It is just what most of the lads in our town do. They think it over for six months, and then some afternoon after school they decide to build. The layout is based upon what can be finished before it is too dark to see. That's one of the big troubles with Amateur Radio, Junior Grade.

The next and last session of the Convention was scheduled to be a big dinner and a general good time. Until you get acquainted with the A.R.R.L. Spirit, you do not know what this means. I had suspicions of young women in scanty attire dancing on top of tables and sitting in folks' laps—home brew—professional brew—etc., etc. You know what some of these alleged all around good times degenerate into. There was a big crowd with clean collars and slicked back hair gathered in one of the big dining rooms at seven thirty. They looked radio to me, and as there were several ladies who looked like the wives and sisters of radio men, I thought it was good enough for me, so I sailed in with the crowd.

There was a big dinner layout, with darkly waiters, music and evening clothes and things. It looked like a right smart bunch. It made you feel glad to be numbered among such a crowd. Amateur radio in St. Louis was some snooks. The game opened in regular style for these things. It was not long before they pulled another one of their gags. Yes, they pulled several. In fact, Mr. Bessey nearly got pulled all by himself. He certainly is the gay little village cut-up when he gets away from the Pacific Ocean. He is no colt, but by heck he has yet to learn what a harness feels like.

The first bout was a speech by the President after Benwood Bill had introduced him. This was short and had to do with bright young radio men. Several other distinguished gentlemen followed with short spiels about nothing in particular, and we were just getting the grub stowed where it would do the most good when Mr. Benson lost his temper. It seemed that some bone headed waiter kept slopping soup on him. It happened five times running, and as Benson had his spike tailed coat on it got his goat, and he hopped to his feet and was for dusting the place

out with the coon. For gawdsake, thinks I to myself, here's another row. What a hair trigger lot these St. Louis folks are. Here was a first class hotel dining room, and by heck if there was not going to be a regular row right here in the room. Benson got himself all fussed up and completely red headed, and was making motions at the darky. I honestly expected a knock down and drag out was to be staged right there before our very eyes. The damwaiter talked back and seemed like he wanted to fight, too. A white man and a nigger mixing it up simply will not do where I was brought up, and race riots and police floated before my mind. They got to pushing one another, which is always the last thing before actual business begins. Then, when all seemed lost, the "waiter" burst into a tenor solo. Benson smiled, rolled down his sleeves and took his seat.



Benny is so little that we almost lost his picture, even.

Well sir, I was plumb buffaloed. The singer was a dark complected one and had been hired to pull the slop job, and Benson was as good an actor as he was. Better, in fact. The singer had a white jacket on, and blamed if you could tell him from a waiter. I certainly hand it to the St. Louis bunch. Here's mine! Take it away! It's all yours, St. Louis!

After we got our dislocated emotions back into place a lot of breezy chippies in abbreviated clothes blew in and sang, walking around among the tables and paying especial attention to Mr. Bessey. He came from the land of sunshine and flowers, so he did not repel their advances, so as you would notice it. Then a little fat man who needed a hair cut wheeled in a business that looked like a Big Bertha. He said it was a moving picture camera and that he was going to take a movie of the bunch. The machine had wheels and things, but it looked to me as though it would have to go to a blind asylum to pass for a movie camera. They all began hollering and shoving and waving their arms and napkins, and my nerves started to get on edge again, expecting some new trouble was about to squat on us. Then

something exploded. There was a puff of smoke, the movie camera flew into bits, and a little girl made up like a fairy, appeared in the centre of the wreckage. The music started, and she recited a pretty little poem dedicated to the "A.R.R.L. Spirit".

This brought down the house and then Mr. Bessey announced he must sing. He explained that he had held in all evening and that the limit had been reached and that unless he got a chance to bust into song pretty damsoon, something inside him would bust open. There had been so much blowing up going on, and Bessey is so ample, it was decided to take no chances. They had a lot of the song hits of the day all printed, and arrangements were made to get Bessey's trouble off his system. We sang "Smiles", and "Tears" and "Mother" and "Mother-in-law", "Tipperary", and everything there is to sing. The more they sang, the louder they wanted to sing and the more Bessey got lit up. Things were at the top note, when Mr. Godley fell off his chair and fell against a side door and pushed it partly open. The ladies at the next table took a look, and gave a wild whoop of horror. When Godley came up for air he had the worst scared look on his face I have seen a man wear for some time. He scrambled for the door and yanked it shut and cast a guilty look around. What it was on the other side of the door that scared him so, he did not disclose. Paragon Paul ought to have told us.

Well, I'm blamed if I remember much from here on. Things got sort of blurry. There were speeches and jokes just as at one of those "down home" parties, where everybody knows everybody else and all hands have a cracking good time. Everybody loosened up. Funny! Most of us were total strangers, and yet our A.R.R.L. had brought us so close together we felt like one big family. I tell you it is simply great. It warms the cockles of your heart in a way they are seldom warmed. I've heard tell of the wonderful A.R.R.L. Spirit, but I never dreamed it was real. She is a real thing, boys, and you poor SOls take note.

I am not just certain, owing to the noise and confuson, but I think Benwood Bill called on his Mother-in-law to make a radio speech. That shows the length to which Bill went. When a man picks on his Mother-in-law for a radio speech, he has some colossal nerve. That's Bill all over. It was a nice little speech, but the lady did not look old enough to rate the Mother-in-law rank.

The shindig ended with a few good-bye speeches which were very impressive and thrilly. Director Anthony of Muncie, Ind.,
(Continued on page 19)

An Electrolytic Rectifier for C.W.

By P. J. Furlong, 1FF

A.R.R.L. City Manager of Boston

THE C.W. propaganda of QST during the past year is really to blame, you know. We felt that we must have a C.W. set, but could not make up our minds to come across with the spoudulicks to get that motor-generator set, and besides, fashions were likely to change in transmitting tubes, and one could not tell how many volts would be correct to drape around these tubes if one wanted to be up to date and keep in the best society. Most of us decided to hang off C.W. for while, and await the discovery of some device that would drive the manufacturers of motor-generators into bankruptcy.

The electrolytic rectifier is not a new discovery by any means. Remember the time you made one up to charge your storage battery? Come now, admit it. You gave it a trial anyway, before you decided to spend twenty-eight seeds on that Tungar. Yes, I admit, it was sloppy, mussy, gassy and everything else that's punk, but don't let that make you turn up your nose and murmur: "Poor Nut", same time turning over to "Calls Heard". If you live in an apartment, where the music from the rotary is not appreciated, or the ducking of the lights, while you vainly chase that pleasing double frequency which your quenched gap is supposed to give, try this idea.

This story really started six or seven months ago. Ask any Boston amateur to describe the horrible sounds he was picking up. I did not pick 'em up, as I was very busy making them. Things have changed, however, and instead of these awful wails of agony filtering thru your receiver, there is now sweet melody and laughter. You should hear that soloist, 1FF, accompanied by 1JB on his A.C. harmonica, render that sad little ballad, "How is my A.C. hum?"

But to get at the dope, you say. Sixty cycle A.C. was first tried out about six months ago. Energy in antenna O.K. but very uncomplimentary remarks from the audience for going back on my old quenched gap. Of course no attempt at rectifying was made. Scheme No. 1 given up. Consulted experts on transformers, traveling all the way from Boston to Cambridge, to see if a frequency-changing transformer could not be doped out. Nothing doing, so Scheme No. 2 was in the discard. Self rectifier—use two tubes, get both halves of cycle and increase frequency; good idea; worked it, just exactly

as Mr. Ruckelshaus describes in December QST, but I never dreamed it might be used to fone. However, the audience neglected to heterodyne me and reported very unfavorably on Scheme No. 3, which went to rest with its brothers.

About this time 1JB, a partner in crime, said it was rumored that Mr. Bussey of the General Electric Co. had succeeded in rectifying 750 volts with an electrolytic rectifier. I had done some research work in a radio laboratory, during which time many different types of rectifiers were experimented with. I became familiar with the good and bad points of the aluminum valve rectifier, but got to know the bad

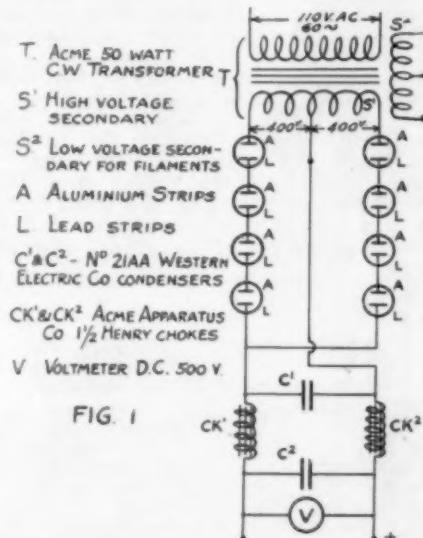


FIG. 1

ones better. However, it was decided to give the thing a trial, and once started results came along very fast. The darned thing works like a charm. I can now pound the key after ten P.M., or if I feel inclined, say sweet things to 1JB with the fone. And as for the Electric Light Co., Huh!, I snap my fingers at them, and the neighbors—they must think I have moved far far away, because the lights don't duck.

An Acme Apparatus Co. 50 Watt C.W. transformer was used throughout. It has a split secondary—410 volts to each half. The drop in voltage thru the rectifier brings this down to between 350 and 375 V. according to how much juice the filament on the transmitting tube is drawing.

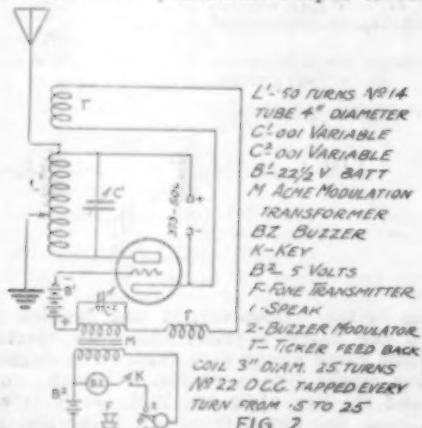
The transformer has a low voltage secondary for lighting the filament. I have used a VT-2 Western Electric tube and it works on this transformer as if they both went to the same radio school.

The rectifier consists of eight $\frac{1}{2}$ pint jelly jars, of the straight variety that come with screw tops. Eight strips of aluminum and eight strips of lead will be needed; dimensions, one inch wide and about five inches long. A hole is punched or drilled in one end of each strip, which by the way are $\frac{1}{8}$ inch thick. An aluminum strip and a lead strip are then fastened together with nut and screw, bent into an inverted-U shape, so that the lead strip will be in one jar and the aluminum in another. We have then two lots, each consisting of four jars in series. Fig. 1.

Next mix up a 2-quart vessel full of a saturated solution of borax—less than half a ten cent package of 20-Mule-Team Borax does the trick. It is important that this solution be all made up at once, in order that density in every jar will be the same. There is no critical break-down voltage, and distance between plates in jars does not seem to be of importance.

The next step to consider is the filter circuit. Fig. 1 also makes this clear, I think—two Acme $1\frac{1}{2}$ -henry chokes and two 1-mfd. Western Electric Co. condensers, No. 21-AA, tested to 1000 volts.

The filtering of the output from this type of rectifier seems to be a much easier job than that of a tube rectifier. A D.C. 500-volt meter put across output of recti-



fier reads 375 volts and no flickering of hand on meter. Tube rectifier throws the hand up and down over 50 volts unless carefully balanced with filament rheostats on rectifier tubes.

The rectifier was put in commission two weeks ago, and has run about four hours every night, has needed absolutely no attention so far, and positively does not heat up. The transformer, rectifier and

filter are in a small box under the table, where they take up less room than the smallest motor-generator set.

At the present time I am using a Colpitts circuit and Heising modulation (see pages 6 and 7 of May QST). I get good results with grid modulation, tho I very much prefer the Heising. The only disadvantage of this circuit is that the drop in voltage, due to extra load of modulator tube, pulls the voltage down to 250.

1JB, who worked with me on this dope, gets 0.6 to 0.7 amps antenna current and

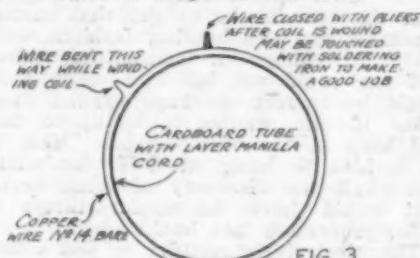


FIG. 3

has worked about 30 miles, grid modulation and one VT-2. 1BAY—well, see October and November "Calls Heard" for his distance. 1KBE has motor-generator and this rectifying stunt. He can change from one source of current to the other, and at two miles I can find no difference.

A few hints, I suppose, will be in order. When the rectifier is first used it will be noticed that the transformer secondary heats up badly. This is natural, as the rectifier is a dead short circuit. Pull your switch and allow transformer to cool off. It will take about 15 or 20 minutes to get the coating of aluminum oxide on the aluminum plates. This is called "forming the plates". Once they are formed no further trouble from heating will be experienced.

If the plates are placed in the order shown in Fig. 1, the tap from center of secondary will be positive, not negative as is marked on the transformer. A change in the order of plates will reverse polarity, of course.

While the little 50-watt transformer is entirely satisfactory, it would be better to use a separate transformer to heat the transmitting tube filament. Any change in load on the high voltage secondary will affect the output of the filament secondary, and this will not be any too good for filaments if using anywhere near maximum current while tube is oscillating. This applies particularly when key is used in ground lead for straight C.W.

Don't throw your high voltage on until you have filaments lighted up. This favors the separate transformer for filament heating.

(Concluded on page 28)

The Washington's Birthday Relay

AS announced in last QST, Mr. W. H. Kirwan (mail address, Box 148, Davenport, Iowa), old 9XE, is arranging for a nation-wide relay on the night of February 21st with the co-operation of the A.R.R.L. Operating Department.

This will be a brand-new idea in relays—the transmission of a 30-word message from President-Elect W. G. Harding, addressed to all governors and mayors, which is to be copied by every amateur and delivered to his proper local official. The messages will be so routed that they will be receivable in every part of the country, and everybody can get in on it. If we do the job well, we will make a splendid demonstration of the value of amateur radio to the community.

The message is to be split into three sections and started in different parts of the country. At 8:10 p.m. Eastern Standard Time, Feb. 21st, 1AW at Hartford will start one section which will move to the west coast via both the northern and the southern routes, and will consist of the 2d, 4th, 6th, 8th, 10th, 12th, 14th, 16th, 18th, 20th, 22d, 24th, 26th and 28th words of the message. At 8:10 p.m. Pacific Standard Time, Feb. 21st, 7ZB, Vancouver, Wash., and 6ZK, Sunnyvale, Cal., will simultaneously transmit another section consisting of the 1st, 3d, 5th, 7th, 9th, 11th, 13th, 15th, 17th, 19th, 21st, 23d, 25th, and 27th words of the message, which will be relayed across the country. The remaining words, the 29th and 30th, will be broadcasted to QST at 10 p.m. Central Standard Time, Feb. 21st, by 9BY, Rock Island, Ill., using 4 amperes of C.W. energy on 200 meters. 9BY's C.W. set should be heard over a radius of 1000 miles, but the third section transmitted by it will be taken up and relayed to both coasts by the regular trunk lines.

Provisions will be made to get the message to every part of the country and to safeguard against failure. As soon as the main relay clears a division, Division Managers will start that section thru the short-jump routes on low power for the benefit of the small stations that cannot receive long distances. At 9, 10, 11, and 12 p.m., Central Standard Time, 9BY will QST such parts of the message as have been received by it, on 200 meters C.W., and 8XK will also be asked to repeat the sections as received. NSF will repeat the sections received by it, but only on schedule, which schedule will be broadcasted and relayed over the trunk lines during February. At 12 midnight 9ZN, NSF, and 8XK will broadcast the complete message. Additional particulars will be

transmitted by 9ZN during February; 9BY will make an announcement by radiophone every night starting Feb. 1st at 8:15 p.m.; and 9ZS, Springfield, Ill., will broadcast information every night after time signals.

In the event strays or "dead" conditions make it impossible to get the relay across the Rockies on the 21st, it will be tried again at the same times on the night of the 22d.

This is going to be a hard relay and will thoroughly test our ability. The idea is to collect the sections, piece out the complete message, write it in ink or typewriter on an A.R.R.L. message blank, noting the time and station from which received, and deliver at the first possible moment to the governor of your state, the mayor of your city, or the highest local official (even if he's only the town constable), securing his receipt, and reporting all particulars to Mr. Kirwan. Many prizes in apparatus are being secured and will be awarded the stations who do the best jobs. The contest is open to everyone.

We all know what to do to make this a success—the same things are necessary as in all our other undertakings: cordial co-operation, the reduction of QRM by the elimination of all unnecessary transmitting, and the resolution that we are going to put it across in typical A.R.R.L. style. So tune up the old set, fellows, get a few A.R.R.L. blanks handy, and be ready for one of the biggest amateur events in years.

ROTTEN S.O.L.

(Continued from page 16)

made an especially good speech. So did Brother Warner and Mr. Stewart and Mr. Bessey, who had calmed down by this time. The last one was by The Old Chief himself and I will say he impressed us all. He made it stick out a foot that CITIZEN RADIO, as he likes to call it, is a dignified thing. He drew a picture of the future that held us for fifteen interesting minutes. It capped the job in good shape, and when he finished and said his "Good Bye, St. Louis", we all felt as though we had been to church and had listened to a good sermon. I'm not strong on sermons, but just the same I have heard one or two cracker jacks in my time, and they always leave a nice taste in the mouth. That was the way we felt as the closing scenes of the St. Louis Convention were enacted.

It seemed too darned bad to have to break up. I say once more, I had the daggondest best time I have had in twenty

(Concluded on page 23)

Transatlantic Sending Tests

MANY of our readers have no doubt read in Everyday Engineering Magazine of the transatlantic sending tests arranged by that magazine to take place the first week in February, with numerous English amateurs preparing to listen in on the other side. Everyday Engineering very unfortunately has been obliged to suspend publication, and its radio department editor, Mr. M. B. Sleeper, has asked the A.R.R.L. to take over the tests and see them thru.

Our Operating Department has been glad to do this, for the good of Amateur Radio and in order that Mr. Sleeper's excellent idea for the first transatlantic tests may not be wasted. Arrangements have not been completed fully at this writing and it is impossible to give schedules, etc., but the plans of Mr. Sleeper will be followed with as little change as possible, the American entrants probably transmitting on schedule on the nights of Feb. 1st, 3d, and 5th.

It is regretted that many of our A#1 eastern spark stations have been unable to enter the contest and at this late date it is probably impossible to secure any more entrants. It would have been extremely interesting to see what success these stations would have, as we believe their chances would have been better than those of the majority of the entrants who contemplated the building of special tube sets for the tests. While we are very hopeful that at least one of the entrants will be heard overseas, the British amateurs have not had the practical experience in short wave reception that we have benefitted by over the past ten years, and so

they are working under more or less of a handicap. Fortunately, however, the average British experimenter is more of an engineer than an amateur, and they have a way over there of going into such things in a most painstaking fashion, so that we may expect that a number of them will have built sets and multi-stage amplifiers especially for these tests. We are pleased to note that the general trend of design in amplifiers for this purpose seems to be the use of tuned inter-stage circuits for amplifying the radio-frequency, and except by the use of the Armstrong super-aurdyne, we do not see how the amplifying arrangement could be improved. The tests are to be 200 meters, and as they have QRM from a British navy wave length of 214 meters, their amplifiers will be sharply tuned at 200 meters, so that our transmitting stations will have to be tuned to within a meter or two of this wave length. Altho a hard job, it will give some excellent practice in the absolute obedience of the radio law, and it will have to be done if our signals are to be heard by the British stations.

The arrangements in England are in the hands of Mr. Philip R. Coursey, Assistant Editor of "The Radio Review", London. We expect to have a report on the outcome of the tests from Mr. Coursey in our next number. If they are successful, we hope that arrangements can be made for the relaying of amateur traffic to England on schedule, and at the very least they should have inspired the British amateurs with the ambition to persist until finally they succeed in copying the American amateurs.



Miss Ham gives permission, via radio, for a nearby amateur to call on her. She has never seen him and now it looks as if others has been listening in also.

Some Whys, and Speculation as to Some Possible Wherefores

By M. B. West*

Mr. West needs no introduction to our readers. His practical articles we count among our best contributions. Here is another kind of article—one designed to make you think about the immense possibilities for improvement in design which exist in our spark transmitters. What have you to say about his ideas?—Editor.

MY curiosity is aroused as to the possible explanation, in simple terms, of the widely different behavior of different transmitting stations. Why, for instance, does some well tuned station with an antenna current of six amperes have a range of only a few miles and another station almost identical in construction, with an antenna current of two or two and one half amperes, work over half the continent? Why is it that an antenna will work very much better both as to radiation, decrement and signal strength at one certain wave length (usually about twice the natural period but differing in every case in its relation to the natural period, depending seemingly on its type, the number of wires and its surroundings)?

We have been told often and again of the advantage of "saving up" our one K.W. and letting it out in "chunks", and of the tremendous values of current which flow in the antenna when the maximum instantaneous value is considered. And some of us have developed our transmitters until these values, mathematically considered, rise to tremendous values. And then along comes some one with a little "insignificant" antenna, a few tubes, and other "junk", and with an input of fifty or sixty watts and an antenna current of less than one ampere, works across the Atlantic.

Stop and think a minute. With the spark transmitter, you save up that one K.W. and let it out in "chunks" so that the actual rate of discharge may reach 100 K.W. or more. The current flowing in the antenna as measured on the meter is only an average value and the maximum instantaneous value may reach, in an amateur transmitter, the surprising value of 7,000 or 8,000 amperes. The voltage on the antenna reaches surprising potentials. All of these should result in a considerable disturbance of the ether, and generally do.

However, with the C.W. transmitter, our output is constant with the input. There is no such thing as saving it up. Radiation as shown by the ammeter is the average value of the alternations and represents the same relation to the maximum value

as in ordinary alternating current. Potential is low. And not all of the energy received at the distant station is useful, as in heterodyne reception only those waves that add to or oppose the waves set up in the receiver actually are useful in producing the signal.

So it seems to me we have material enough for a pretty big WHY. To me, at least, even considering the reasons ordinarily given, there is a discrepancy that will require more than ordinary explaining.

Mr. Alexanderson, in an account of his recent address to the members of the Institute of Radio Engineers, made several references to "power factor" which to say the least aroused my curiosity as to its probable effect in radio frequency circuits. As a result I was soon thinking "power factor", reading "power factor", and mighty soon talking "power factor" to any one that would listen. Read up on it yourself. Even tho it may have little bearing on radio problems you will find it a very interesting subject to speculate about.

Power factor or phase displacement is to me best explained by first considering the case of a condenser. When a condenser is connected to a source of direct current there is instantly a tremendous rush of current into the condenser which quickly dies down to zero as the potential across the condenser rises to that of the D.C. supply. This in effect results in the current preceding the potential and when the condenser is connected to a source of alternating current the amperes do flow into it before the volts and we have phase displacement, and actually current flowing in a positive direction while there is a negative potential! But as the power in the circuits is measured as watts, which are the volts times the amperes at a given instant, the actual power is very much less than the number of amperes would indicate. And as any losses that occur in such a circuit are usually current losses, these excessive current values cause a correspondingly greater proportion of loss than if the volts and amperes were together and so could simply be multiplied to determine the power in the circuit.

Now consider a large coil of wire wrapped around an iron core. Connect

*Pre-war SAEZ; member A.R.R.L. Advisory Technical Committee.

this to a source of direct current and we find that the greatest current does not flow at once, as there is a counter electromotive force generated by the coil which opposes the flow of current until the core is fully magnetized. Connect this coil to a source of alternating current and we find the amperes lagging behind the volts and as in the case of the condenser we will have to have a considerably greater current or potential than would seem to be necessary in order to transmit that amount of power thru the coil. Again the volts and amperes

it would seem that if two circuits are coupled together by a transformer, each circuit having different values of capacity and inductance, we would have a variety of power factors at various points in such an arrangement but should be able to find a point in which the power factor would be that resulting from all factors combined.

Now take Figure 3 as representing the values of capacity and inductance in an ordinary closed circuit. Consider it as energized and high frequency current flow-

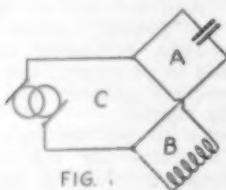


FIG. 1

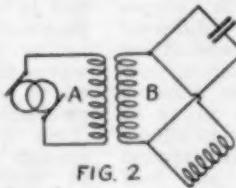


FIG. 2

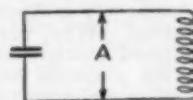


FIG. 3

do not come at the same time, but this time the amperes are coming later.

If we should connect a condenser and coil together in the same circuit and properly proportion the capacity of the condenser to the inductance of the coil we could exactly balance one against the other so that the tendency of the current to lead in the case of the condenser alone would be neutralized by the tendency to lag in case of the coil alone, and the result would be that we would transmit our power thru such a circuit with losses occasioned only by the resistance of the conductors and dielectric.

In all radio circuits we have both inductance and capacity but it is seldom likely that they are so balanced as to produce ideal conditions. In fact it seems that no attempt at all is made to balance them. Should, as may easily be the case, these values be so combined as to give a very low power factor, this may account for the amazing values of current that are sometimes encountered, and for such large proportions of loss as seem to take place.

When we consider various combinations of inductance and capacity in branch circuits we find the problem still more complicated. In Figure 1 we have a source of alternating current supplying two branch circuits. If we measure the power factor at A we find it very low, with current leading. If we measure it at B we find it also very low but with current lagging. But if we measure it at C we find the power factor high, depending on the resultant of the two values of capacity and inductance. Now if we add a transformer as in Figure 2 (disregarding resistance and supposing a "perfect" transformer) we will find the power factor measured at A and B to be the same, still being a resultant of the values in the two branches. In consequence

ing. If we measure the power factor at the condenser we should find it very low with current leading. If we measure it at the inductance we should find it very low with the current lagging. But might it not be possible that if we measured it at some intermediate point, such as A, we would find the resultant of the two and get a point where if power were taken from the circuit the volts and amperes would be in phase? Why not at this point insert a turn in each side of the circuit, wound in opposite directions, and from these turns transfer our energy to the

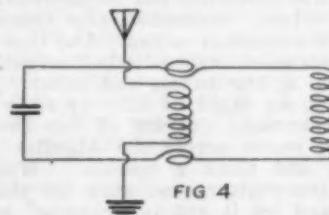


FIG. 4

antenna? See Figure 4. Of course these turns will have inductance and their effect will be additive but their proportion to the whole need not be large and they could be nearer to the condenser.

But we have introduced other factors. We have coupled this circuit to another which in turn has other values of inductance and capacity, and which predominates. If we could distribute these values equally throughout the antenna system we would have the same power factor at all points and if we could balance the factors we could secure a power factor of unity at all points. As that portion nearest the ground would seem to have the greatest capacity per foot of wire we could bring our wires close together near the ground and spread

them apart as they rise from the ground, and so to some extent at least distribute the capacity uniformly. If inductance is lacking we might coil the whole antenna and by properly spacing the turns distribute the inductance also, of course using such turns as are necessary for the proper degree of coupling.

Of course the above is pure speculation. But think a moment. Suppose we consider a transmitter as a piece of apparatus the output of which in watts is constant. If the power factor is near unity these watts will represent very low values of potential and current, but considering resonance effects, if the power factor is very low, especially at different points in the circuit, we will have tremendous values of current and potential with correspondingly greater losses. It is power that makes the distant signal, and watts are what represent it. It would seem therefore that it would be of importance to secure as low a power factor as possible in such parts of the apparatus as really transfer the energy. And at least to some extent we have the inductance and capacity under our control.

While the above does not explain any of the questions outlined in the beginning, it does in some particulars seem to point to a possible explanation and to me it has seemed extremely interesting. Its purpose is to make you think.

It is not my intention to put forth any new theory. Technically there are no doubt serious errors in the conclusions drawn. But it would seem that some explanation is about due for the very great differences in results attained. Perhaps some discussion will result which will at least help solve these problems.

TRANS CON RECORD SMASHED !

As QST goes to press we have the glorious news that our A.R.R.L. has broken the transcontinental relay record by handling a message from Hartford to Los Angeles and return in 6½ minutes. Complete details of this and the other Transcons will be in March QST. It is radio history. Don't miss it.

2ZM'S RADIOPHONE—C.W. TRANSMITTER

(Concluded from page 8)

freely and over a comparatively wide range.

OPERATION—Drum switch at point 0 or neutral position opens all circuits. At point 1 to left connects antenna to receiving set, still leaving all circuits open. At point 1 to right connects antenna to transmitter, closes filament and high voltage circuits, and connects two tubes as oscillators and two tubes as modulators, and is the position for either phone or buzzer transmission, either of which can

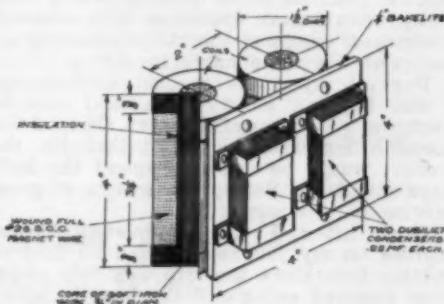


Fig. 7.

be used by changing SPDT switch to left for phone and to right for buzzer. At point 2 to right, still closes antenna, filament and high voltage circuits and connects all four tubes in parallel as oscillators for C.W. transmission, which may be sent out by inserting a few turns shunted by a key in the antenna circuit as shown in Fig. 4. The current for both the buzzer and transmitter is supplied from the filament battery through a proper resistance as shown in diagram.

ROTTEN S.O.L.

(Concluded from page 19)

years. If this is what a Radio Convention is, I am for them. It is to be more conventions and less useless apparatus for me in future. You stick-at-homes, who never saw a Radio Convention, you are S O L all right. You St. Louis boys, here's to you! We all love you and hope to see you again. May your sigs never fade and may you live long and may you and yours always prosper!

T.O.M.

The Autobiography of a Message

By Robert S. Quimby 1AAG

Here is a story with a moral. All of us have heard perfectly good messages accorded exactly the treatment that befell the one in this story. Let us take this matter a little more to heart, fellows, and exercise the gray matter in routing our traffic.—Editor.

I WAS born, December 12th, in a town not far from Boston, and christened Msg. Nr. 13. Rather an unlucky name, thought I, as I found myself coming into being under the pencil of my creator, who was soon to send me on a journey to his friend in the city of Blank, N. Y., whom he had not seen for many moons. But no more unlucky was I than many, many more messages with whom I afterwards made acquaintance, having all met with the same misfortune.

For all my name seemed so unlucky, I was happy. Happy because I was to perform a very useful duty; that of informing my writer's friend that he, the writer, would be down to spend the holidays with him. Surely I was to be of great service in this world.

Soon after I was completed I was started on my journey. I had no fear of getting lost, since the trip was only about four hundred miles and the boat in which I was to cross the ethereal sea, tho small, was sturdy and of full 1 K.W. power. My happiness knew no bounds now, for I was sure of a good start and a fast journey to my destination. For a while I was sure my thoughts had been correct, for, altho it was not the kind of night generally considered best for long distance transmission, by the aid of my powerful motor and favored by a calm sea I was soon laid gently onto the antenna of a station located in western Massachusetts.

After passing thru an endless lot of wires and what not, I at last found my way to the 'phones and whispered my message to the operator. Great was my joy to find he heard me and understood my importance. For he was at that moment pounding his key to the effect that he would get me off as soon as possible.

He did! In fact he got me off just a little too soon, for had he stopped to consider, at least some of my misfortunes never would have come to pass. But as he listened to the GN of my creator, he was suddenly attracted by the calling of some far-off station. What was it they were saying? He began to manipulate the knobs on the front of the box thru which I had just come. At last he had them tuned in and he listened to the soft clear note calling, "CQ CQ de 2XYZ QTC?"

At this point my joy came to a sudden end as I heard him say, "2XYZ; Hm! Wonder who he is." (Goes to call book looks up 2XYZ) "Ah! New York City—don't know where the city of Blank is but 2XYZ is a good two hundred miles away and if I can make him on my $\frac{1}{4}$ K.W. it will be something to talk about." At this point he heard his own call being sent by a station about a hundred miles from him in a north westerly direction and with whom he had often talked. This station was also asking "QTC?". For a moment my hopes rose. Perhaps, thought I, he will stop and see where the city of Blank is and then give me to this station.

But no. The lure of long distance held him in its power. Without stopping to look up the location of the city of Blank he immediately called the station he had heard last and sent "QRU OM GN". Then began the struggle for fame. "2XYZ 2XYZ de 1ZYX," sang the spark, time after time, but with no answer. Finally I was laid aside, while other messages of less importance were sent to various nearby stations.

After several hours of waiting I suddenly heard the spark calling 2XYZ again. This time there was an answer. I watched the face of my guardian glow with pride as he realized he had got thru to New York City. But as his joy increased so did my gloom as I heard him say "Hr msg for NY OM", and then felt myself lifted from the hook as he received the QRV, and realized I would soon be speeding to New York City, some two hundred miles in the wrong direction. I began to wonder where I would be sent next.

By this time I had arrived at the station of 2XYZ; a nice cozy place it was, too. But what interested me most was a large map hung near the set. "Now", thought I, "I should at least be sent in the right direction". But as it was early in the morning my new guardian was about to turn in for a few hours sleep before going to work at 7:30. (How they do it is beyond me.)

On the next night I was once more started on my journey, but the sea was rough (my sender called it QRM) so I got but a short distance that night; tho thanks to my guardian, who had taken the pains

to look up the town of Blank on the map I had noticed, I was now headed in the right direction. The next couple of nights were the same. I began to get worried lest I should arrive too late and thus be of no use. It was terrible to think of after what I had already been through.

On the fifth night, however, the storm subsided, and I went sailing away to a town only ten miles from my final destination. My mind was at last relieved. Ten miles! and three days left before my creator would leave to visit his friend. Surely I would be in time now. My joy was suddenly quelled, however, as time after time my new guardian tried to get me through to different stations located in the city of Blank. Every time the story came back, "Sorry OM, QRM, can't make it now, CUL, GN". I was finally put up on the hook where I stayed 'till the next night.

On the next night my guardian again tried to get through the storm but with no better luck. At last in desperation he called the nearest station to him and sent me on my way. Great Guns! I was worse off than before. I was now fifteen miles from the city of Blank. All evening the

storm raged and I was tossed around from town to town, always keeping a good fifteen miles away from my goal. Finally when the night wore on I was put up on a hook with a number of other messages.

How long I stayed there I never knew, having lost consciousness from grief as the next night came and went and I realized I could be of no use in this world of wireless. When I came to, I was aware that someone was talking about me. Finally I made it out. My last guardian had raised the station which was to be my destination. What I heard filled me with horror. It was just this:

"Yes OM have msg for you", (at this point I was lifted from the hook and sent to the station at Blank). At last I had arrived at my destination! My receiver was now pounding the key and I caught the words "Thanks OM, but I guess its a little late as my friend has gone back after spending two days, and all his money, at the Hotel. We didn't expect him so couldn't put him up here GN OM CUL".

And with that I was crushed in strong hands and roughly thrown into the waste basket.

A Simple Wavemeter for Use with Oscillating Circuits

By Allen H. Wood, Jr.

THE proposition of getting a wave meter to calibrate long wave CW receiving sets has been somewhat of a problem to the average amateur for a long time. They can of course be purchased but the price is prohibitive in most instances. Then, too, the wavemeters of this type offered on the market are complicated and employ vacuum tubes for circuit driving or other arrangements which necessitate critical adjustment before the meter can be used.

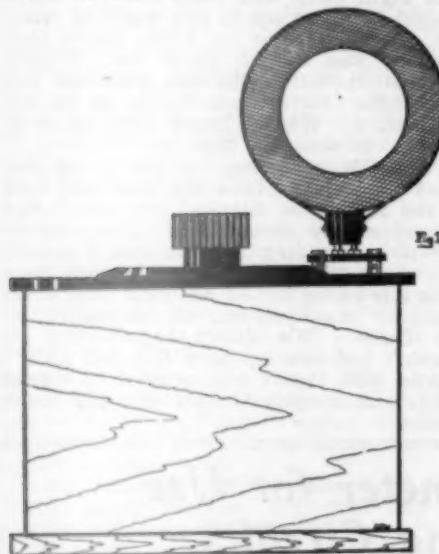
A wave meter is a very useful addition to any station and especially so where a long wave set is in operation. The foreign arc stations and some of those in our own country have a distracting habit of sending for hour after hour without signing off or giving any indication of who they are. When an enthusiast is trying out a world beating circuit and hears a distant station in operation whom he thinks is China, it usually gets his angora not to be able to check up the station he is hearing. If a fairly accurate wave meter is used and the wave length of the incoming signals is noted, it is easy to form a pretty definite idea as to who is sending. This is especially true of the foreign stations whose wave lengths vary enough to limit the guess

work almost to a certainty. The very simple wave meter described below can be calibrated easily, either by a radio company or by the maker himself without much trouble. Its low cost and ease of operation make it a desirable instrument for every amateur. It should be clearly understood that this wave meter will function only on OSCILLATING CIRCUITS, inasmuch as it does not generate its own oscillations.

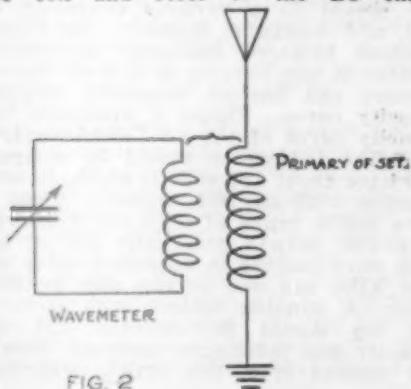
The apparatus necessary is simply a capacity and an inductance. The capacity should be a variable condenser of .001 mfd. maximum capacity. The Clapp-Eastham balanced condenser is recommended in this instance as it is of low resistance and has an unusually straight capacity curve. Figure 3 illustrates the capacity curve of the CE-Y800A condenser. The inductance should be compact and have about 125 m.h. L which, in conjunction with an .001 capacity, gives a wave length range of 5500-19000 meters. This will include practically all of the long wave stations in operation today except XDA and one or two ship installations. A suitable cabinet with a bakelite top should be obtained and the capacity and inductance mounted. Details are omitted from this article regarding

mounting as every amateur has some particular method of assembling his apparatus. All the wiring necessary is to shunt the condenser across the coil and the wave meter is ready for calibration.

Any of the companies who manufacture radio apparatus will calibrate the meter



for three or four dollars, or the calibration may be fairly accurately plotted by the maker by the following procedure. Start at 10 degrees on the capacity chart in figuring, not at 0 degrees, as at this point the added capacity of the condenser is of the same order as the distributed capacity of the coil and calculations are very uncertain at the best. Obtain a standard LC chart of which there is a copy in nearly every book on Radio Telegraphy. The units which we shall use are microhenries and microfarads. Multiply the capacity found at 10 degrees by the inductance of the coil and refer to the LC chart.

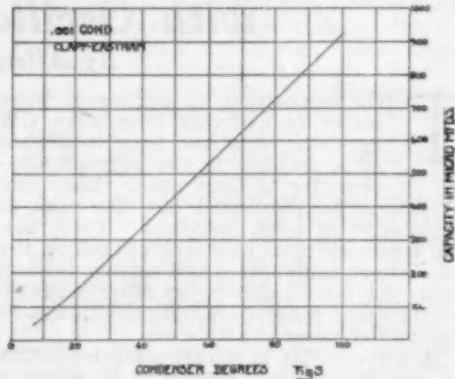


Suppose we find our product to be 8.67. We find the wave length directly indicated as 5550 meters. If a standard LC chart is not available the same results may be obtained by the following formula:

$$\lambda = 1885 \sqrt{LC}$$

Let us go on another step. Referring to the capacity chart we take the capacity at 20 degrees. Multiplying this by the inductance of the coil, we find say 15.83. Looking at our LC chart we find this indicates a wave length of 7500 meters, etc. By this method the wave meter can be calibrated to within about a hundred meters of accuracy, which is close enough for long wave work.

The method of using the wavemeter is simplicity itself. Bring the inductance of the wave meter into the field of the primary coil of the set and move the condenser on the meter back and forth. When the two circuits are resonant there will be a click or a squeal in the phones depending upon how fast the operator goes past the point of resonance. If the set incorporates a galvanometer in the plate circuit the resonant point is clearly indicated by the flickering of the needle. No changes are necessary in the receiving set in order to use this wave meter. Simply put the set in operation as usual and when you hear



a station of doubtful origin whose wave length you want to know, bring the wave meter in the field of the primary coil, adjust the condenser and read the wave length on the chart. This is further shown in Figure 2. Figure 1 shows one form of this wave meter which is doing excellent work in the writer's laboratory.

(Note: The use of the wave meter in this manner forms the so-called sensitizing circuit for long wave reception as described in QST for October, 1919, page 3, and will by itself increase signal strength several fold.

It will doubtless occur to the constructor to make use of a standard Universal-wound coil for the necessary inductance.—Editor.)

Amplifying Bulbs

By A. E. Harper

SINCE the termination of the European War a number of foreign bulbs have turned up in this country, obtained in various rather peculiar ways, which have constants unfitting them for use with circuits designed for American tubes. While in the army the author was given the opportunity to test some of these bulbs and collected some data which may be of service to radio men who have possessed themselves of foreign made tubes.

Before considering any specific type of bulb let us review for a moment the properties that all amplifying tubes have in common. The amplifying power of a tube depends on the change of plate current in amperes produced by a change of unit volts in the grid potential. This constant is called the mutual conductance of the bulb. It may easily be seen in Fig. 1 that a change in grid voltage of dE_g will produce a change in plate current of dI_p . The mutual conductance is obtained from the equation

$$\frac{dI_p}{dE_g} = G_m \quad (1)$$

To calculate this constant it is only necessary to take two points on the straight portion of the characteristic curve, find the difference in voltage and the corresponding difference of plate current in amperes, and divide. The bulb having the highest mutual conductance is the best amplifier.

This constant is connected to the other tube constants by the equation

$$G_m = \frac{k}{R} \quad (2)$$

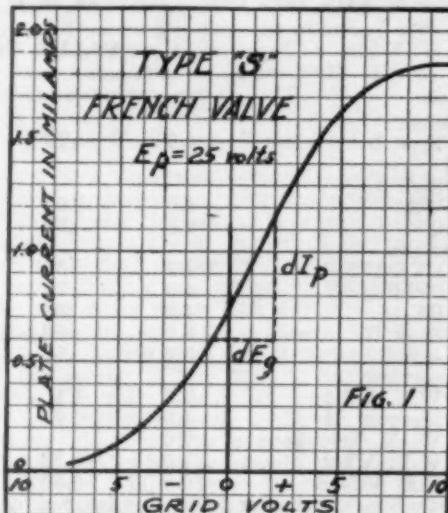
where k is the constant of voltage amplification, and R is the internal resistance of the tube.

Some idea of the characteristics of a bulb may be gained from an inspection of the elements. A bulb which has a very fine grid, or a very small spacing between the grid and the filament, will usually have a high constant of voltage amplification. The reason for this is the fact that the electrons gain in velocity as they approach the plate. If the grid is near the filament it controls the flow of electrons before they gain a high velocity and therefore produces larger changes in plate potential.

The internal plate resistance also may be estimated by inspection of the elements. If the plate is large and near the filament, the resistance of the bulb will be low; however, it must not be too near because the ratio of plate-filament distance to grid-

filament distance must be kept great in order to give the tube a high constant of voltage amplification.

From inspection of the table it will be seen that the American-made bulbs lead the world. Probably the best tube obtainable is the Western Electric VT-1, or Type J as it is called by the makers. Its mutual conductance is .0005, more than twice as high as any other bulb. In



addition to its high amplifying power it only requires 2.2 volts filament. The most economical way to use these tubes is to place two in series on a six volt battery. This combination saves the power that usually is lost in the rheostat. Less power is consumed in lighting two of these tubes than is used in one Marconi bulb.

The W. E. telephone amplifying tube is probably superior to the type J, but it has several disadvantages. It is hard to obtain, it requires 250 volts on the plate while the J tube operates best on 40 and uses more power in the filament.

The French bulb is the most important of all the foreign tubes because all the others are copies of it. The French caught the standardization bug from the United States and designed their type S tube to operate as a detector, amplifier or generator. Its characteristics are practically the same as those of the Marconi bulb. It was used as a detector on 24 volts, as an amplifier on 60 volts, and as a generator on 400 volts.

The Germans used another method in producing their tubes. They captured a

number of French valves, redesigned them for special uses, and improved them not at all. Almost a dozen types of tubes were found on the battle field, all bearing signs of having a common French ancestor. A special type was used as a detector for spark sets, another type was used for receiving undamped signals, while still another kind of tube was used to amplify. The best valves they had were the A.E.G. amplifier, and the R.E. 16 continuous wave detector. A number of tubes captured could not be tested because they were burnt out or the glass was broken.

The British bulbs in the early part of the war were very poor. Recently some

very excellent tubes have been developed, but the data on these tubes is not at present available. Capt. Round has designed a bulb for radio frequency amplification at low wave lengths which has a very low grid capacity.

C.W. sets are so popular now that this article would not be complete without some mention of VT-2 and VT-18. VT-2 is made by the Western Electric Co. for low power transmitting sets. It produces about 4 watts of oscillating energy. The General Electric VT-18 is a high power tube, putting 40 watts into the aerial.

VALVE CONSTANTS

Name	Filament		Plate		Mutual Conductance	Det Amp Gen
	Volts	Ampere	Volts	Resistance		
French Type S	4.0	.70	24	24,000	.0002	
British V-24	4.0	.67	65	54,000	.00018	Amp
Q	4.0	.30	50	200,000	.0001	Det
German EVE-173	4.2	.62	65	40,000	.00015	Det
Sedding	4.0	.70	65	40,000	.0002	Det
RE-16	4.0	.62	65	24,000	.0002	CW
S. & H.	3.0	.50	70	60,000	.0001	Amp
A.E.G.	3.2	.56	75	35,000	.0003	Amp
American W.E. VT-1	2.2	1.1	60	20,000	.0005	Amp
Marconi II	4.0	0.7	60	35,000	.0002	Amp
W. E. Telephone	7.0		250	4,000	.0015	Amp
W.E. VT-2	7.0	1.36	300	5,000	.0014	Gen
G.E. VT-18	10.0	6.50	800	50,000	.0002	Gen
Det=Spark detector	CW=undamped detector		Amp=Amplifier	Gen=Generator		

AN ELECTROLYTIC RECTIFIER

(Concluded from page 18)

If you don't possess a milliammeter, use a 3-volt flashlight bulb in your plate circuit. If tube does not oscillate readily, be careful to watch tube, as well as flashlight bulb. Tubes can heat up to such a degree that all the elements will collapse.

The inductance L' was quite a problem to produce cheaply. Cardboard tube $3\frac{1}{4}$ " diameter, shellaced, and when tacky wind full with large chalk line or good manila cord. Let this stand over night. In the grooves then wind on No. 14 bare wire, 50 turns, tapping every turn after 15th. The cord keeps the turns separated. To take off taps, bend wire as in Fig. 3, leaving bend about $\frac{1}{4}$ inch open; when winding is finished and end of wire is securely fastened, these bends or loops should be closed with pliers, and as an extra precaution they may have a little solder. Closing the bends results in a very tightly wound, good looking coil, which is easy to handle.

Don't think you are going to improve matters by cutting out some of the rectifier jars. If you don't like their line-up, add more jars. Don't skimp on the filter circuit, either; a few more condensers will improve it.

Should any further information be desired on this rectifier the writer will be only too glad to let anyone dropping a line have same.

DON'T YOU WANT TO JOIN THE A.R.R.L.?

Any member of the Operating Department personnel will gladly take your application and acquaint you with our activities in your section. A bona-fide interest in Amateur Radio is your only requirement for membership. Ask your District Superintendent for an application blank, and become a member of an organization that DOES THINGS.



Are We Appreciative?

ARE we—of the wonderful privileges which we American citizens have under the law which permits us to practice amateur radio? You will answer a careless "Yes", but are we? Do you know that this is the only country on the whole wide globe where citizens can engage in radio to anything like a reasonable extent? Consider Canada with its 50 meters, Britain with its 10 watts and restricted aerials, France with its ban on everything except meteorological information, Germany with its absolute "verboten". In this land of the free we have the glorious privilege of operating undisturbed in our little domain if we comply with certain simple requirements—but how many of us comply? All too few, fellows, and it is therein that we say we are not properly appreciative, for if we were we would rigidly live up to the spirit of the wave length and decrement law.

Because a Republican Congress did not give a Democratic administration enough funds to fully enforce the radio laws, we have been allowed to drift. And in drifting we have unconsciously taken a few meters here, a few there, until today the average amateur tune will be found many meters above the legal 200. Men, if the law were enforced as it should be, over 90 percent of you would be shut down at once, and many of you with too-long aerials could not reopen until considerable rebuilding had been done. Of the general amateur stations we hear here, we should say that less than 10 percent are within the legal 200 meters. Is this appreciative? It is not—it is carelessness, and it must be stopped before we get into trouble.

Fellows, the wave length **must go down**. 200 meters is your limit. Get down there and stay there. Don't think that this is something that we're printing for the other fellow—that it doesn't apply to you. It does—if you are an average amateur. Your wave is too long and it's YOU to whom we are talking. YOU must realize that this is a thing that YOU are responsible for and that YOU alone can

remedy as far as your own station goes. For the good name of Amateur Radio it is up to YOU to get busy at once and get your wave down to 200. The A.R.R.L. expects every man to do his duty in this important matter.

False Calls vs. Bum Fists

EITHER a considerable number of bums or was it a rotten fist? Gawdnose. We can cite other instances: 3AH was copied by 4DL while he was out of town, and again by 9FG while he was in bed, again by 1OE and 8AL at other times when the little squeak box was idle. Consider the bird near Boston who calls various DX men and signs 9ZN, thinking that because his antenna is not connected no one hears him. Does he like the roll in the ZN so much better than his own call? 9ZL reports 2EN in December and 2EN's range, when he stopped operating three months ago, was three miles. Who is the gent who has appropriated Don W. Moore's call of 4CJ and has been reported by 4DY, 4AM, 8IZ, 1BG and 9AIT? Who is the 1HBA near Montclair, N. J., where respectable "1" calls have no business straying? Who is the 7AQ that friend Groves down in Virginia heard calling 7AD?

Judging by the number of calls we can't read at all, and some horribly mutilated ones that we just happen to know, it is not surprising that some signals should be reported in places where they could not reach. We must watch this, fellow amateurs, or the value of our "Calls Heard" reports will diminish. Some operators who ordinarily send well enough have a fancy swing in their call which makes it impossible to decipher, or else it sounds exactly like something entirely

different. We caution more care in signing off—let your signature be unmistakable. Hang the pretty swing—get some precision. And watch how much oftener you are reported.

As to the malicious falsifiers, it is our intention to bring the full pressure of the law against the first violator we can catch, and we feel that all good amateurs will help us in this.

Stolen Autos

IN an Editorial under the above heading in our November issue we spoke of the value we could be to the community in assisting the police in the recovery of stolen automobiles, and suggested that our members see their local police and endeavor to inaugurate some such service.

We are happy to see that our requests are bearing fruit. In St. Louis, station BCO sends a broadcast at 6 o'clock every night announcing the stolen autos, escaped convicts, etc. The police are so interested that they have purchased radiophones, one of which is at headquarters and the other installed in "the wagon". At Dallas, similar arrangements have been made and 5ZC is sending out the data. In New York, where the police have their own station, the arrangement is a little different, as described in the "Affiliated Clubs" section of this issue.

Now to get to the point of this message: The information that is broadcasted must be copied and promptly delivered to the chief of police in every nearby town. It is of no avail to go to the labor of having the reports sent out if no use is made of them. There is where we come in! Let every amateur who hears these reports make it his business to report the data to his police. In that way the news will be in all the towns surrounding the city, and thru one of them the stolen auto must go. If your police pick it up thru the service you rendered, you have brought credit to yourself and Amateur Radio. The effort will be small, and the results well worth it.

QRX for Time Signals

IT does not seem to be commonly known that the radio law prohibits interference during the period time signals are being sent. Perhaps the impression is that our short waves do not interfere with the long wave signals but within short distances the QRM from forced oscillations will be very troublesome. Our attention has been called to this in a letter from Radio Inspector Kolster who advises us that the regulations are being so constantly violated that the many jewelers who depend upon the time signals from NAA are seriously inconvenienced, and the

Jewelers Association has made a formal protest.

The law reads: "As a general rule, all radio stations whose transmissions might interfere with the reception of such signals and radiograms (time signals and meteorological radiograms) shall remain silent during their transmission in order that all stations desiring it may be able to receive same."

Our Operating Department requests that we keep our transmitters silent for a period of about seven minutes, commencing a minute before and ending a minute after the transmission of the time signals. The transmissions on the east coast take place during the five minutes preceding noon and 10 p.m. Eastern Time and on the west coast at the same hours, Pacific Time. Let us do this.

The Midwest Convention

IT'S gone, but not forgotten, nor will it be for many moons. There has been no more joyous affair in the history of Amateur Radio than the A.R.R.L. Convention staged at St. Louis on Dec. 28, 29 and 30. Friendships were made there that will live forever; radio acquaintances were met face to face that before had been known only over the air; for the first time in our life we saw under one roof men from every amateur district in the country; we had three glorious days crammed full of radio from early morn to as late as one could keep awake, with three big meetings where we could get up and chew the rag about every conceivable subject that enters the amateur brain. Oh but it was great!

We didn't feel that our own prosaic style was at all suited to the artistic reporting of this famous conclave, and so, our dear friend "The Old Man" actually being there, we asked him to undertake it, feeling that his gifted pen would do nearer justice to the meeting. His report will be found elsewhere in this number, and we know that all who attended are with us in a feeling of profound sympathy for the "Rotten S.O.L.'s" who were not there.

Incidentally, our A.R.R.L. Board of Direction had a meeting in St. Louis during the Convention, where for the first time our directors from the west and south actually sat in with those from the east and north, and we feel that the better understanding all of us gained by that meeting will do lots in strengthening our organization.

Calls Heard

CALLS HEARD are a peculiarly interesting part of our QST. We often wished we could have room for more of them. It has finally percolated thru to

us that the way to achieve this is to print more of them. This we are going to do, and in this issue we encroach upon the other departments to the tune of an extra page or so, and we shall do still better—if it meets with your approval.

There are many of our readers whose lists of calls have never been published, and doubtless many of them wonder why. Men dear, if you could see our hook for Calls! It's a meat hook to start with, but it's full and dripping, and the bunch we take off each month is as a drop in the sawdust. We clean it off every month and start all over in an endeavor to publish only fresh stuff, but it quickly fills up again. Obviously there is nothing for us to do but to select the best lists, and that we are going to do. We ask you to turn to "Calls Heard" and read the introductory note this month, explaining how we are going to handle them in the future. We feel that this method is calculated to bring all of us the best possible results from this department in our magazine, and we ask your co-operation.

About Ourselves

WHAT does the A.R.R.L. do with its money? Who gets the profits of QST? Is it true that H. P. Maxim, et al., own and run that A.R.R.L. outfit to get in a little jack on the side?

Did you ever meet up with any of these questions? Perhaps, instead, you have been solemnly assured that the A.R.R.L. was got up by a few New England men who wanted to organize all the amateurs west of the Hudson River to "use" them for handling their traffic, just to add to their fun.

So we want to say a little word about ourselves. It happens that the man who had the original idea of a relay league, our president, lived in Hartford. He had to live somewhere. But his idea was of a national and self-governing organization, and that the A.R.R.L. has always been. Our headquarters happen to be in Hartford. They have to be somewhere, and really this is a very good place for them, as we are close to the territories from which we get most of the advertising that makes our magazine possible and yet we avoid the extremely high operating costs of the larger cities. And as to the nature of our organization and how it is run, if these lines meet the eye of any reader who does not know the story, let him read:

The members of the A.R.R.L., by popular ballot, elect seventeen directors as their governing body, to serve for two years. The present board has another year to serve. These seventeen directors in turn elect our five officers from their number. Our constitution and by-laws define the duties of these officers, describe our Oper-

ating Department and tell how it shall be run, and provide that the League shall publish a monthly organ, which is our QST. No one commercially interested in radio can be a member of our Board, and except for our traffic manager and secretary, who devote their entire time to our work, no one gets a penny out of it. It belongs to the membership—which is to say that our A.R.R.L. is an organization composed of you men who read QST, that you collectively own this League and QST, and that thru the directors you elect you control its activities. That the good old A.R.R.L. stands the test of time shows that its principle is a sound one. And, men, we are growing every day.

Now about our money. The League acquired QST as its own property shortly after the Armistice at a cost of a little under five thousand dollars. It had no money, and the funds to purchase QST were raised by our A.R.R.L. bonds, with which all of us are familiar. These bonds come due in May of this year, and ever since we resumed publication in June, 1919, it has been our strong aim to save enough money in the two years to make the payment. Our source of revenue is our magazine, and, having no surplus cash, from the very start it was necessary that QST should pay its way. This it has done—it has flourished and prospered and increased in size and still made some profit, which we have put aside to apply on the bonds. (Incidentally, don't you see why we wanted you always to mention QST in writing advertisers, and urged you to buy from our advertisers? It meant results, and that meant more advertising and a bigger QST—regenerative action. It worked, too—QST right today is producing better results for the advertisers who spend their good money with us than they get from any other magazine in the country.) To get back, as we grew we had other expenses of course, and we were fortunate that we had this margin of profit to meet our expenses. We needed extra office room, more office help and more equipment, we hired a traffic manager because the job had reached a mountainous size, and we have had legislation to fight, postage to pay, trips to Washington to make—hundreds of things to do to further the interests of the membership of the A.R.R.L., which only the fact that QST had a margin of profit made possible at all. So it has been a good thing for the League, but, fellows, QST is not owned or run individually, nor does its profit go to any individual. Our traffic manager and our secretary work for weekly wages of forty and thirty dollars, respectively, plus a commission on the results they produce. When they fail to produce results that is all they get. The rest of our

February, 1921

Q S T

directors get no compensation—they serve with the same spirit that actuates you men in your capacity of official relay stations, love of this fascinating game of ours!

We expect that by close shaving we will be able to pay our bonds when they come due in May, altho it is a little early to say for sure. What then—what of the future? It is up to our Board to say what changes will then be made in our policy, but probably we will go on much the same. We will not have the same incentive to save up so much money by a certain time but we will have the many other expenses of our organization to meet and the added possibility of undertaking valuable constructive work if only we can finance it. Just for one example, we would like to have money to pay the salaries and traveling expenses of two or three bang-up good men whom we could send around the country to tune stations, help fellows get going, solve the hard problems that now confront many of us, and so on. This would be splendid work for Amateur Radio, and it is just one little idea. To carry out this and other such ideas we will have to continue to make a little difference between our receipts and our expenses, but if any profit is made it will be used for such purpose as this and not for the enrichment of any individual, because our organization is so got up that is cannot be used in any other way.

The Poindexter Bill

AT this writing S-4038, the Poindexter Bill, is still in the Subcommittee on Radio of the Senate Committee on Naval Affairs and has not yet been taken up for consideration. Opinion is divided as to what action will be taken on it, rumor having it that it will come up very soon, and then again, other folks think Congress will be too busy to give it any attention during this session. One thing stands out: we amateurs have made ourselves heard in Washington and there is not a Senator but knows that S-4038 is vigorously objected to by thousands of his constituents because of its unsatisfactory provisions. Our objections are bearing fruit, and the general attitude of the Senators seems to be the realization that this bill must be amended to protect the amateur. Letters have been received by our members from several of the Senators, some taking an active interest in our behalf. Those from Senator Poindexter, however, show that that gentleman is himself not fully aware of all the provisions of the bill bearing his name, as he insists there is nothing in it unfavorable to us amateurs. This shows that we are widely apart in our views, and as the Senator intimated the possibility of further hearings,

we have asked that they be held. Our Board of Direction has appointed a strong committee to go down to Washington and represent us in the event the hearings are held, and we may now expect that if the bill is ever passed it will be with amendments that properly protect the interests of Citizen Wireless.

The Pacific Convention

SPEAKING of conventions, they had one recently out in San Francisco that was a real one too. In Mr. Bessey's "land of sunshine and flowers" they have a way all their own when it comes to tackling such propositions as conventions, so we were not surprised to learn that the meeting was a wonderful success, with nearly six hundred radio men in attendance, representing every branch of the art; that they had very complete exhibits of apparatus, commercial, navy and amateur; that clubs and communities from the whole length of the coast were represented; that in regular convention style they had a Resolutions Committee whose duty it was to frame resolutions to present to the convention in order that positive action might be secured on constructive measures; and that many such resolutions providing for increased co-operation among the amateurs in the handling of traffic, etc., were passed unanimously and no doubt have already resulted in improving west coast operating conditions.

At this convention the question arose of forming a separate relay league on the Pacific Coast, to be entirely independent of our American Radio Relay League. Now you know, fellows, a representative group of radio amateurs can not be got together unless the bulk of them are A.R.R.L. men—that's just what we are, the good amateurs of the country, united in a national organization. So of course the San Francisco meeting was full of loyal A.R.R.L. members. The good constructive measures, we said, were put over unanimously, but the resolution to form a separate relay league was overwhelmingly defeated.

It was splendid to see this demonstration of our strength and unity of purpose. It shows that the west coast men appreciate that our A.R.R.L. truly is a national self-governing body, and that a relay organization, to be successful, must be national in scope. More important than this, it shows that they realized that there is not room for more than one relay organization, and that we must keep united the whole country over that we may present a solid front in our fights against unfair legislation. Finally, it was a concrete proof that the plan on which the A.R.R.L. is

(Concluded on page 48)

THE OPERATING DEPARTMENT

F. H. SCHNELL, 1MO
61 Waverly Bldg., Hartford, Conn.
TRAFFIC MANAGER



DURING the month of December the Pacific and Northwest Divisions set aside the hour between nine and ten o'clock each Monday and Wednesday night for the purpose of listening for stations east. During these periods no transmitting took place. So far we have heard from 6OH that he has recorded 9AO. Now, fellows, get out your map and look at the distance. This is something worth while and may be the means of getting over the mountains from the Mississippi Valley in one jump. Mr. Bessey advises that they are so pleased with the effort it will be continued until further notice. There is a chance for all of you now, so go to it. The time is between 9 P.M. and 10 P.M. Pacific Coast time, every Monday and Wednesday night.

Canada Comes Through

Just recently messages were received in Hartford the day following the filing date from Ontario Division Manager Russell. It has been quite impossible to trace the exact routing, and as far as we know the messages were given to 8ANJ from Russell. How did they come from 8ANJ? Further test messages are going to be run so that we may determine definitely the routing.

Northern Trunk Line

Perhaps last month's report stirred up the fellows on Trunk Line A, because the traffic has been coming and going over that route during the past month in commendable style. The only hitch at present is that some of the operators must sleep once in a while.

Southern Stations

We still need help in the southeastern part of the country if we are to move traffic consistently. Surely some of you desire to hold a place in our traffic route. Mr. Merritt, East Gulf Division Manager, has many good positions open for amateurs with good stations who seek such offices.

Total Messages

Again let me ask that every amateur in each division send in a monthly report of the total number of messages he has handled. Send this report to your Division Manager in time for him to incorporate it in his report, which must be in this office not later than the FIRST of each month.

Some of the Divisions are handling an immense amount of traffic, but no com-

parison can be made until every Division sends in a report. Last month the Central Division made a wonderful showing, largely because most of the fellows in that division sent their report in, while only a very few in the other divisions reported to make up the totals. Keep your Division out in front by helping your Manager, and let's see which Division really does the business. As soon as possible we will publish a monthly score, so, fellows, if your Division is to be on top you must send your reports in and on time.

The Division reports follow:

ROANOKE DIVISION

W. T. Gravely, Mgr.

All sections of the Division are progressing and with a little more high pressure, there will be efficient stations at all important points.

The University of Virginia station, 3YV, is now in the air, and Mr. Roger Wolcott of the University Radio Club advises me that permanent apparatus will be in place by January 1st, and they expect to maintain a watch up to 1 A.M. All messages for Virginia points north of Lynchburg, should be given to 3YV, except those for points near Richmond, which should go through 3ZL or 3TJ.

The Division is handling traffic, through 3EN, 3FG, 3GO, 3VV, 3AHK, 3BZ, 8SP, 8ZW and 4DM.

District Superintendent C. D. Blair, Central Virginia, has been granted a special license, with call letters 3ZL, and will use a working wave of 350-375 meters, with calling wave of 200. He will deem it a favor for anyone hearing 3ZL to write him care of P. O. Box 859, Richmond, Va.

O. M. Selph, 3TJ, Richmond, has completed a $\frac{1}{2}$ K.W. set. It is particularly requested that amateurs in Petersburg write the District Supt. Those residing at points between Richmond and Washington, Richmond and Danville, and Richmond and Lynchburg, please get in touch with Mr. Blair. Mr. Blair is an enthusiastic worker and can be relied upon to link up his District with the other Districts.

Superintendent Wohlford, 3CA, Roanoke, reports he is very optimistic over the prospects, and says he is expecting good stations at the Virginia Military Institute

(Lexington), Staunton, Wytheville and Galax. Mr. Wohlford is another hard worker. His own station, 3CA, is booming, and he is always willing to clear any traffic coming his way.

Supt. Heck, 8EF, Mannington, W. Va., reports a great deal of traffic going through 8SP of Fairmont, W. Va., and by the way, the Division Manager has found this station very effective in clearing for 3BZ at Danville, for points north and west, when it was almost an impossibility to clear through a more direct route, due to the fearful QRM and QSS. It has been found that it is very easy to clear from Fairmont to Danville, through 8SP and 3BZ. 8SP is a consistent worker.

Superintendent Bunker, 3CE, Charlotte, N. C., reports that 4CQ of Charlotte is reaching out and that tests are being made with the view of opening up the main Southern Route. Mr. Bunker will have a 1 K.W. station in operation by Jan. 1st, which will give Charlotte two reliable stations. 4CQ, Mr. Gluck, is an old commercial operator.

From the Virginia Seaboard, thru City Manager White, Norfolk, and Supt. Herndon, Portsmouth, come good reports. There gentlemen are to be congratulated on their performances under such severe handicaps. They may be heard every night, and at all hours, working faithfully to clear the traffic, which is heavy. They are assisted by 3GO, 3VV and 3AHK, also hard workers. The A.R.R.L. is indebted to these loyal fellows for their splendid co-operation and consistent effort.

The head of our Technical Committee, Mr. A. L. Groves of Brooke, Va., has had his "bumps" lately—and worst of all he has had a fine new aerial and pole blown down but—another is under way.

The Manager wishes to say that he is being ably assisted by Mr. Clark, 3AEV, of Danville. He is a willing, consistent, hard worker.

City Manager White, Norfolk District, reports there is another station in operation belonging to Mr. Gilpin, Manager of the Radio Corporation of America, here at Norfolk, call letters 3AB. Mr. Hopkins of 3GO has had considerable trouble. He has changed his antenna again; now to a 4-wire "T" type about 75 feet long. Mr. Herndon of 3FG has his Hy-rad going again and is pushing through in fine shape. Mr. Kubiac of 3VV is still going strong and has handled a good many distance relay messages from all parts of the east. Mr. Hiram Bennett of 3ACT, Norfolk, is in operation and handles a few msgs. The same is true with station 3ACE, Mr. Koon of Portsmouth, Va. There are two other stations; one in Newport News, call 3QQ and one just outside of Newport News, call 3AAG.

3EN is now in operation again and has succeeded in working with 9BW of Wichita, Kansas, a distance of 1125 miles; has also been heard in Anthony, Kans.

NEW ENGLAND DIVISION G. R. Entwistle, Mgr.

Getting ready for those Trans-Continents! All set in the First District. Yes, we've even got thru to Portland. The Route is—1CK (1DY), 1PAW, 1DAC, 1UQ, (1FV), and reliable. Also the northern route between Boston and Hartford—1WR, 1BT (1BAY), 1GY, 1GBC, 1JQ, 1AW, (1BBL). We all know that the southern route cannot be beaten, therefore there is no necessity of discussing the merits of—1CK, 1HAA, 1AW.

On January 8th we pulled the strings on a daylight test on the above routes from Boston to Hartford, Boston to Portland, and return. The tests started at noon from Boston.

On December 21st, a message was relayed from Governor Coolidge of Massachusetts to the Governor of California by Amateur Radio. In less than one hour from the time started the message was at 9EQ in St. Louis in spite of local QRM'ers. How's that? Thru this medium a great deal of publicity was gained by the A.R.R.L. in the Boston newspapers. The routing was 1CK, 1HAA, 2TF, 8ZH, 9EQ, as far as we know, and was handled in great style.

Mr. Furlong, (1FF) City Manager, reports traffic conditions good around Boston and 1AE, 1EP, 1ES, 1CK, 1DY clear their files quickly. Also that the time schedule suggested by the Executive Council is being supported locally and it is almost possible to do some DX work before 2 A.M. C.W. and Phone sets are numerous in and around Boston; for instance, 1AE, 1CK, 1FF, 1EP, 1JB, 1PT, 1BV, 1PL, 1BBO, 1JK, 1DR, 1YS, 1SAC, 1YC, 1XM, 1XE, etc. The arc at NAD is showing signs of QRM again on about 200 meters.

Mr. Robinson (1CK) says that 1HAA, 1DY, and 1CK are handling a bunch of traffic between them and communication is very reliable, day and night. During November 1HAA handled over 250 msgs. with a total of about 6000 words.; 1CK handled about 160 msgs. with a total of over 2000 words, and 1DY carried his share of the burden well. 1HAA has sent a service to Boston stations stating that no more msgs. for foreign countries will be accepted, therefore all traffic for Springfield, Worcester, and Portland is broadcasted ten or a dozen times and then mailed. Canadian traffic is being shoved across the border OK; 1HAA has a schedule with 2AX (Canadian) at 8:50 P.M. every night. Counterpoises are becoming popular in the

eastern section. 1GBT, 1DY, 1EAV, 1CZ, and 1CK are among the latest converts to 1HAA's way of thinking.

Superintendent A. V. Johnson (1DY) reports things proceeding well in and about Lynn. The one exception to this is the mania of the local men to try to horn into the DX class and persist in calling anyone they hear, outside their range.

The N.E.A.W.A. opened its season with a meeting at Franklin Union, Boston. Very satisfactory meeting under the direction of Lester A. Pulley, 33 Porter St., Melrose, Mass.

A. D. M. Mix (1TS) was able to QSR a bit this month but was compelled to do all work on low power due to condenser trouble. Other stations having condenser trouble were 1AW and 1FW which put this section out of the running for a while.

D. S. Nichols (1BM) reports southern Connecticut in fine condition. 1BM has handled a total of 60 msgs. during the past month and has logged 149. He averaged 4½ hours for thirty nights on watch.

D. S. Randall (1NAQ) reports all to the berries in his district. He has handled a total of 60 msgs. in spite of transmitter trouble.

The main clearing stations for 1NAQ are 1XT and 1BBL, who is giving 1AW a lift with traffic.

D. S. McLean (1JQ) has been unable so far to break thru to 1GY and there seems no immediate promise of a solution to the atmospheric problem. However, 1GBC at Southbridge can serve to clear traffic both ways.

A. D. M. Castner (1UQ) has divided the State of Maine into 13 districts. Castner is not superstitious. State-wide test was run successfully on Dec. 12th. We expect the University of Maine to install a good tube transmitter in the near future.

Total Messages 530.

EAST GULF DIVISION E. H. Merritt, Mgr.

Probably the most phenomenal work being done in this division is by 4AI and 4YB on CW, fone and spark. 4AI has been reported from Buffalo, Toronto, Chicago, Philadelphia, Burlington, Iowa, etc. 4YB has been reported QSA many times in Canada, New England States, etc. 4XB and 4DM have also been heard in Canada. Will 4DM please write in and give us his name and address? 4YB has handled over 30 msgs. in the last four weeks and 4AI is also taking traffic.

4AG is still doing the same good work as usual. He reports that he has taken 25 msgs. in the last month, most of which had to be forwarded by mail.

4AO is with us again and we welcome his return to the game. This gives us an

open route for traffic as far south as Jacksonville.

A few days before Xmas, 4BK made himself known by reaching out and taking several msgs. from DX stations. He is on the job nearly every night and reports that he raises a new DX station every time. He has worked 4AN, 4AG, 4YB and has been heard in Atlanta, which facts are most remarkable, as peculiar local conditions make it very hard to work these close stations. 4BK has handled 6 msgs. since opening up.

4XC has been unable to work regularly but he is ready for 'heavy duty' again.

5XA is doing good work north and south of him, but except for one or two occasions, he has been unable to work east. His sigs are often QSA in Atlanta and other Georgia cities but, seemingly, all signals from Georgia jump over 5XA to 5ZP, 5YH and others. Mr. V. C. McIlvaine of Auburn, Ala. (5XA) is District Superintendent of Alabama and would like for all men in his district to get in touch with him by mail as soon as possible.

Occasionally 4AN is heard on the air and he has worked several stations to date.

4DA has been heard "feeling around" several times while testing out. He was reported from Ohio on a daylight test with Atlanta stations.

Nothing has been heard in some time from 4AT and others in south Florida. We would all like to hear what progress is being made down there. Why not write of your difficulties at least?

Our attention has been called to stations being erected in Midville, Georgia, and Gainesville, Florida. These two stations are admirably located for relay work and we will be very glad to hear them open up soon.

Although progress is slow down here, we have a little more territory covered by radio in each report.

Total messages 61.

WEST GULF DIVISION F. M. Corlett, Mgr.

Mr. Burle Jones, 5BR, has returned to Muskogee from Kansas City where he has been attending college, and will soon have his 1K.W. going.

A.D.S. Poor, of McAlester, reports prospects for stations at Lehigh, Farris, Shawnee, Haileyville and Krebs, Oklahoma.

Dist. Supt. Louis Falconi of the New Mexico District sends us a few little notes about the west.

Mr. Noll has resigned as Asst. Dist. Supt., in charge of the El Paso, Texas Territory.

Traffic for the west coast is being handled through stations 6IG and 6ZH with clocklike regularity.

A route to Denver and other points in

Colorado is badly needed. 9AMB is the only station worked with us as yet, but (CWA) Colorado Wireless Association is heard in Roswell exceedingly well.

5ZJ is helping in making connection with El Paso, Texas, and State College, N. M., and 5BW at El Paso is also heard.

Traffic for Texas is easy, as stations are numerous and always on the job.

From November 15 to December 15 a total of 123 messages were handled by Mr. Falconi mostly relay business cleared through 6IG and 6ZH to the West Coast.

Harold P. Heafer, Dist. Supt., for Northern Texas, is right at his post directing League matters right and left and in a manner that is commendable.

Plans mentioned in last month's report have begun to materialize in a manner which is pleasing to us all, and a report will be forthcoming on the developments.

Clyde S. Mosteller has been relieved of his duties as Asst. Dist. Supt. of The Pilot Point Texas Territory, and has moved to Dallas. This territory has been consolidated with the new Dallas Texas Territory, which enlarges the latter with Mr. John Dorsa, Asst. Dist. Supt., in charge.

The Northern Texas District not including Amarillo and Corsicana handled 175 telegrams.

The Dallas amateurs are making plans to assist the local police in recovering stolen automobiles through efforts of local radio stations, and much publicity has been given this work by all the local newspapers, all of them praising the A.R.R.L. and its members for their splendid co-operation, etc.

Dist. Supt. Wesley Hope Tilley of the Southern Texas District, announces the appointment of Mr. F. M. Reeves, 5BO, as A.D.S. of the Austin Texas Territory.

Mr. John C. Rodriguez, 5ZR, has been appointed A.D.S. of the San Antonio Texas Territory.

San Marcos and New Braunfels are heard regularly and with San Antonio now having a dependable station, we can now establish a Dallas-San Antonio route, and keep this route working regularly the year round.

Mr. Ed. Nettleton is campaigning in his territory for new members and is doing some splendid work in his new office as Asst. Dist. Supt., of the Eagle-Pass Texas Territory.

A.D.S. Daniels of the Houston Texas Territory reports working conditions in that territory are anything but satisfactory during the past month, with QRN still on their sets.

All Austin stations are heard frequently in Houston and some messages have gone through with few repeats but best work has been done by using station 5XB for relay, as all Houston stations can work this

station at any time, day or night on low power. 5ZP has been heard more often and with better strength but still "ND" for certain as yet, although two messages have gone through that route this season. 5ZA is QRK now in Houston and some satisfactory work has been done with him, also 5ZN.

Total messages 298.

NORTHWESTERN DIVISION

J. D. Hertz, Mgr.

CW! We'll say so! 7AD up in Seattle puts one over on us when he comes on the air with a CW set using just common everyday 60 cycle A.C. on the plate. There are several CW sets under construction in Portland since 7AD first blew in. Mason, in Seattle, says, "the note is nothing to brag about, but it sure roars in." In Portland we do not hear the "note", but the CW with its 30 cycle trill is very QSA. It will do one thing 7AD's spark will not do, and that is, come in loud enough to be audible 35 feet from the fones. 7AD uses one Western Electric VT-2, with 350 volts on the plate.

The appointment of Olfan Deguire, 7CW, of Silverton, Ore., has been withdrawn. He has not the time to devote to the work. 7CW will continue active on the air when time permits.

Old Man Static has been acting up here during the past month. Ninth district stations are not heard as regularly, tho 5ZA continues to come in at times.

Great improvement is shown in the eastern part of the Division, and traffic continues to move, the only hitch at present being between 7CC and the western stations.

Traffic from this Division to the south is handled from nearly all states of the Division, and particularly from Oregon.

Astoria has experienced a dead month as far as outside work is concerned.

Mason, 7BK, of Seattle reports: The usual amount of traffic is being handled with California stations thru 7AD, 7IU, and 7IY. Portland stations are heard at times, but swing right out again, and are very difficult to work. Local interference has increased to the point where it is rarely possible to do any long distance work before 10:30 P.M. There has also been very much QRN caused by power line leakage to trees during the wet weather. 6IY is heard here good on straight CW, and the Camp Lewis and Avalon phones are QSA.

There are several stations in and around Seattle who are using power and waves in violation of the Federal laws. They should read the Editorial in January QST on obeying the law.

Miss Dow, 7CB, at Tacoma, reports:

7CE has installed a 4 KW transformer. What's the matter with Portland? No one here has heard any Portland stations for quite a while. The "sixes" continue to roll in as loud as ever, but NIL from Portland. Is it the operators, or is it peculiar conditions? Some new Tacoma stations are opening up for DX work this winter. Among them are 7BC and 7AE. 7CB has been closed for repairs. In the future, Monday, Wednesday and Saturday nights from 8:30 P.M. on, will be regular watches for the O.W.

Friend Teed, 7FT, over in Kuna, Idaho, says that: Considerable activity is being shown by local amateurs. Three stations are reaching out, 7YA, 7GY, and the stations owned by the Martin Brothers. 7YA is not on regularly, but has been heard working UI in Moscow, Idaho, (about 300 miles) and that in broad daylight. 7GY is using three quarters KW, and works 7CC regularly, and has been heard in Los Angeles. The Martin Brothers have not been on very long but have worked stations in Salt Lake City, Sacramento, and Seattle.

Assistant D.M., H. E. Cutting, Box 517, Bozeman, Mont., reports as follows: This month finds a great improvement in the operating condition of the trunk line "A". The handling of traffic by E. L. Wharton, 7EX, Glasgow, Montana, will insure the constant working of the trunk line thru Montana.

7HM, Merwin Elton, Great Falls, has been appointed City Manager.

Radio clubs at Great Falls, Bozeman, Butte, and Glasgow, Montana have all applied for affiliation with the A.R.R.L.

F. F. Gray, 7FL, at Butte says that the radio club there has 36 members, which is 100 per cent of the radio population of the town. They all have sets of some kind or another with the exception of two. Two of these are power sets.

At Portland almost every station that operates on 60 cycle city current seems to be able to get out of Portland. Among those who have been handling traffic during the past month are 7DA, 7BR, 7BP, 7JW, 7ED, 7KB, 7DS, 7ZI, and across the Columbia in Vancouver, 7ZJ and 7ZK. 7JG has also worked out. 7ZB has been on the job with a transmitter a few nights, but has been experiencing great difficulty in maintaining an antenna in place, being located on the top of one of the highest hills within miles of Portland, and very much exposed to the wind.

Traffic goes south without much delay, but not with the ease it should. It seems to be due to the inability of the southern stations to copy the northern boys thru the "California QRM". East and west traffic with 7CC goes easily on some nights. Trouble in this case is with fading more

than anything. North and south traffic with Puget Sound districts only goes periodically, 7AD, 7YS and 7CE taking the bulk of the business. Connections with Astoria have been NIL for some time. Traffic north to 7HE at Kalama, and to 7BV at Kelso goes day or night. Likewise traffic south to 7BH at Salem, and to 7IN and 7CW at Silverton can be worked day or night. 7GQ, Eugene, Oregon, about 100 miles south of Portland, is almost NIL when it is direct working. Traffic for him must go 300 to 500 miles south into the sixth district then come back direct to 7GQ. This is not a freak of a few nights, but is a freak of the Northwest.

DAKOTA DIVISION Boyd Phelps, Mgr.

Radio Traffic thru this Division has taken a big jump during the past month and a large quantity has come from the Pacific coast over the Northern Trunk Route A. 9WU has been able to fill the shoes of 9ZX in working on the Northern Route and has taken a considerable amount of traffic from 7IM and 7CC. 7IM does not usually wish to live on about two hours of sleep per day so 9WU can not clear west every night. He works 7IM earlier when QRM is not too bad and occasionally 7CC and some in the sixth district. 9EE, also at Ellendale, North Dakota, has been doing some reaching out but neither he nor 9WU are consistently received in Minneapolis or St. Paul tho they both work well beyond. 9ZT has cleared with 9WU and 9HM with 9EE but the territory between is equal to three times the distance in other directions.

In the Northern Minnesota District, Mr. Gjelhaug, 9ZC, Superintendent, reports that he has worked 7IM, 7ZG, 9WU and 9EE to the west lately and many others to the southeast. Conditions are very irregular between him and Duluth and Superior as there are times when he knows fellows there are working but he can't hear them. He clears well with 9ZL but lately 9ZL has been coming on the job after 1 A.M. and because of pressure of business 9ZC has had to quit before midnight.

In the District of Southern Minnesota 9HM has been handling the most traffic. He is directional toward the eighth district and works that way better than anyone else in this Division. Other stations that occasionally work outside the Cities are 9XI, 9MB, 9TI and 9OI. Mr. H. R. Hall, 23 Merriam Place, St. Paul, Minn. is District Superintendent and has written many letters to stations in his district but no answers have been received to date. Fellows in this district should wake up and get into the big doings by writing to Mr. Hall.

Mr. Merrill H. Klassy, 1970 Penn Ave. So., has been appointed Minneapolis City Manager and together with Mr. J. A. Hall, City Manager of St. Paul, should make it possible for the District Superintendent to devote most of his time to other parts of his district.

In Sioux Falls, South Dakota Mr. N. H. Jensen, Box 894 has been appointed City Manager. Being a Chief Deputy U. S. Marshal he will know how to skillfully wield the Wouf Hong.

This Division bids fair to do consistent relay work all the year around as the radio season is somewhat longer here.

MIDWEST DIVISION L. A. Benson, Mgr.

9HT reports traffic has steadily picked up during the past month in this district. There are several new stations operating in this district that are unknown to the Superintendent. Mr. Johnson of Oakland is beginning to handle the work along Route 3. Mr. Anderson, 9EW of Omaha, has been doing noble work during the past month. The working hours of 9HT, the station of the District Superintendent, are from 11:30 P.M. to 5:30 P.M. It has been found impossible to work before 11:30 P.M. By next month a Radio phone will be in use at 9HT. 9VE, Mr. Rockwell, of Omaha, has a small set in operation and is getting very good results. During the past month fading has been entirely from stations north or south of this district.

Station are very badly needed in the northwest section of Nebraska. Mr. Stover, 9JA, reports that keen interest is being shown in his territory. 9AEQ is reaching out, and has been heard repeatedly in Massachusetts. The station at Ames, Iowa, 9YI, is going and also 9JN, the latter being heard several times on the east coast. 9ZQ at Oelwein is being read at Washington, D. C. We have 9JA going again and wish to announce that the station will be open for regular work from 6:00 P.M. to 3:00 A.M., on Saturdays and also early all Sunday evening. 9JA has no difficulty now in getting to any part of the state with ease and 9AEQ works St. Joe, and also connects with Omaha and other stations further west. 9ZQ works 9ZL regularly and many other stations to the east and north.

Mr. Stover reports that the correspondence he is receiving is taking the aspect of a big office and he has enough work for two stenographers if he had them. Mr. Turner of 9DU reports that he is writing to 9EL, 9AEG, 9BW, and 9LR, asking them to arrange a day-light test which he hopes to perfect in the near future. Mr. Turner's station is rather handicapped at present due to the fact that he is waiting

for a special line transformer which will be installed in the near future.

Mr. Woods of 9LC requests that stations within approximately 300 miles listen for his radio-phone on which he transmits music every evening on 350 meters; also any traffic going through St. Louis will be handled if possible, by radio-phone or C.W.

Mr. Fritz of 9KO has perfected his route to Kansas City, Sedalia, Jefferson City, and Independence. He states that a daylight test will be run every Sunday morning at 10:30 o'clock.

9LR reports that 9LA of Wakeeney has been coming in good. 9NR of Hoisington is working on his new station. Most of the traffic work is limited to 9LR at present, as 290 msgs. were QSRed thru this station during the month of November and over 200 up to the 20th of December. Many of these were to and from the west coast routed via 6IG and 6GE at Douglas, Ariz., 6WV (ICW) at Denver or thru 5ZA. Has been able to work 6JD and 6KA in Los Angeles but with not enough success to get any traffic thru direct.

ONTARIO DIVISION A. H. K. Russell, Mgr.

The Ontario Division has made excellent progress throughout the past month, and a great deal of active relaying has been accomplished. In fact, the month of December really inaugurated the relaying of messages in any quantity from Ontario to New York State.

The Southwestern District Manager, Mr. Carter, of Windsor, advises the main business of the DX stations in his district has been the assistance of the overloaded Detroit stations in the relaying of messages east and west from and to Ohio and Michigan. The scarcity of good inland stations is proving a great hardship in the development of a good all-Canadian chain, and this difficulty is augmented by the fact that there seems to be a zone along the north shores of Lake Erie and Lake Ontario where receiving and transmitting conditions are not nearly as favorable as when the same stations are transmitting north and south. A large Radio Club has been formed in London, and the District Manager advises that a good powered station is to be erected there immediately for DX work.

Mr. Mitchell, the Southern Ontario Manager whose headquarters are in Brantford, advises that he has no difficulty in getting into communication with stations to the south, but that considerable difficulty is had in working north or west. Mr. Mitchell reports stations heard in every U. S. district with the exception of the 6th. He also advises that the new

(Concluded on page 48)



AS an engineer of real prominence and a member of the Advisory Technical Committee of the A.R.R.L. it is fitting at this time to recount in detail some of the high spots of this man's splendid career.

When a mere boy, Frank Conrad came to the Westinghouse Company seeking a "job." At this early date, the works were located at Garrison Alley, Pittsburgh. He brought with him to compensate for the lack of the usual college training, an insatiable thirst for knowledge, a remarkable ability to grasp fundamental facts and a most retentive memory. He was a consistent reader who stored the contents of books in his fertile memory for future reference. His first work was in the shop making registering trains for the Shallenberger ampere-hour meters.

One day he evolved an idea in connection with feeding mechanisms for arc lamps and with a rough sketch, he invaded the office of the late Albert Schmidt, then in charge of the engineering work of the Company. Philip Lange was with Schmidt at the time. Mr. Conrad, in telling about this incident said, "Of course they gave me a stand off, as an idea of value would hardly be expected from a youngster in such circumstances." Although he went away disappointed, he nevertheless made a most favorable impression. It so happened that after a few days, Philip Lange, then in charge of the experimental laboratory, needed a boy to "hold voltage" and to make himself generally useful. Young

Conrad was sent for and asked if he could read a voltmeter. Mr. Conrad, in a recent fanning bee on old experiences, tells us about it in his characteristic way: "Sure I could read a voltmeter, I answered, all the time wondering what a voltmeter was."

"The voltmeter was the old Cardew hot wire type which was the only alternating-current voltmeter then available. An arc lamp was being worked on and tested. I had to take voltage readings every few

minutes but when we came to plot the curve there was something improbable in the results and I then realized that I had read the wrong end of the pointer. The Cardew voltmeter had a round dial with a pointer having a long tail piece. But what saved me was that I happened to find an old voltmeter under a bench and by reversing the dial I went over the readings and was able to correct the results."

Mr. Conrad's real opportunity came shortly after Mr. Lange left on a visit of several months to Europe. He told Mr. Conrad to "look after the place." There was not much to do in Mr. Lange's absence but Mr. Conrad had the run of the entire laboratory and he tried everything he could think of that could be done with the circuits and apparatus. During

this period he augmented the foundation for his future success by developing the faculty of quickly perceiving the fundamental physical basis of any problem.

In this early laboratory, some of the basic problems of the electrical industry were being worked out. The arc lamp was

(Continued on page 45)



MR. FRANK CONRAD, 8XK
—An Example for the Amateur—

WITH THE AFFILIATED CLUBS



The A.R.R.L. announces the completion of bonds of affiliation with the following additional amateur societies, as of December 30, 1920:

Union College Radio Club, Schenectady, N. Y.
 The Butte Radio Club, Butte, Montana
 Worcester North Radio Assn., Fitchburg, Mass.
 Tri-State Radio Assn., Cincinnati, Ohio
 Battle Creek High School Radio Club, Battle Creek, Michigan
 Monongahela Valley Radio Association, Fairmont, W. Va.
 Norwich Radio Club, Norwich, Conn.
 Worcester Polytechnic Institute Wireless Association, Worcester, Mass.
 Canton Radio Club, Canton, Ohio
 St. Joseph Valley Radio Assn., South Bend, Ind.
 The Galveston Radio Club, Galveston, Texas
 Lane Radio Association, Chicago, Ill.
 Bay Counties Radio Assn., Oakland, Calif.

Second Annual Convention of The Third Amateur Radio District

The second convention of the Third District will be held in Philadelphia, Saturday and Sunday Feb. 26 and 27, and all the necessary arrangements are being made to make this affair completely out-class the most enjoyable one held last year. These conventions are splendid things—they weld us in a way nothing else can do, and we have yet to hear of a man who was sorry he attended one. We have had several good conventions in other parts of the country, and now is the chance for the Atlantic Division fellows to get together and have their good time.

The meetings will be held at Turngemeinde Hall, 1705 North Broad St. There will be a technical meeting from 10 to 12 a.m., a business meeting from 3 to 5 p.m., a big banquet at 7:30 p.m., and an entertainment at 10 p.m. The following day, Sunday, visits will be made to prominent amateur and naval stations. Important and interesting matters will be before this convention—we will have legislation and improved relaying to consider, invaluable technical talks that will surely result in improving the station of every man who attends—something doing every minute.

Spread the news and get ready to attend

yourself. We from Headquarters will be there if we can. Facilities for one thousand amateurs have been provided. Banquet tickets (\$2.00) and reservations for board may be had by addressing either Dr. G. M. Christine, 2043 N. 12th St., or H. P. Holz, 1902 N. 11th St., Philadelphia.

Executive Radio Council of The Second District

The Second District Council announces that arrangements for co-operation with the metropolitan police in the matter of stolen automobiles have now been made, and broadcasts will be sent out daily at 7:30 and 11:30 p.m. on a wave of 400 meters by the New York Police Headquarters station, call KUVS, to be copied by amateurs in all nearby towns, who in turn are to notify their local police.

The following form of message has been decided on:

"QST de KUVS—All amateurs copy police broadcast automobiles stolen—Overland touring dark green motor 111865 license NY 276-543—Buick 16 touring blue motor 248761 license Penn C 145—Ford 20 taxicab brown and white motor 11689" etc. Signed "New York Police".

Announcement of the inauguration of this service is being made by several prominent amateur stations in New York, and possibly arrangements will be made to have the actual broadcasts repeated by some amateur stations.

The success of the undertaking depends on the degree of co-operation we amateurs give it, and for the good of Amateur Radio all amateurs outside of Greater New York who can copy KUVS's broadcasts are requested to regularly transmit the reports to their local police and immediately report any information obtained.

Radio Research Club Merges

The Radio Research Club of New York City recently merged with the Radio Club of the Bronx in order to form one strong organization that would combine the facilities of both clubs to further Amateur Radio.

Meetings of the Radio Club of the Bronx are held every Saturday at 8 p.m. at 852 Manida St., Bronx, N. Y. All who are in-

terested are cordially invited to attend.

Radio Traffic Assn., Brooklyn

The main point of interest at a meeting of this club on Dec. 3d was the reception of the concert given by Mme. Tetrazini. This concert, originating from her apartment at the McAlpin Hotel in New York, was sent via Bell Telephone and retransmitted from the station of the Naval Communications Service at 44 Whitehall St., N. Y. C., under the supervision of the Commanding Officer, Lt. Buckner, ably assisted by E. W. Dannals, Chief Electrician Radio, who is one of our members. At the meeting rooms of the R.T.A. reception of the concert was accomplished thru the efforts of one of the officers of the club, Dr. DeWitt L. Parker, who loaned the club his portable receiving set, which consisted of a two step amplifier and loud speaker, which in connection with the aerial of Browne's Business College gave more than satisfactory results.

One of the visitors, Mr. Henry S. Coyer, of the DeForest Company, gave a very interesting talk on the construction of vacuum tubes, both transmitting and receiving. It is needless to say in conclusion that a very interesting evening was spent by both the visitors and members.

Dallas Radio Club

The Dallas Radio Club has secured permanent headquarters and a fine club room located at San Jacinto and Masten Streets, in the building adjoining the First Baptist Church, which building belongs to the Church. Negotiations are under way for installing a radiophone set with a three hundred mile range to be used for the transmission of sermons, etc. This set will be located in the club rooms and will be operated and maintained by the club.

Essex County Radio Association.

Essex County continues to be on the map and is doing much toward the regulation of interference. 1DY, District Superintendent of the A.R.R.L., is always on the job to handle traffic and note local conditions. Essex County as a whole is much pleased with the appointment.

The Salem Section has secured a room from the school authorities and has a class two nights a week in code and theory with about forty enrolled. A County meeting was held November 26th and the whole association voted to become a part of the First District Executive Council.

The Beverly and Lawrence Sections are also giving instruction two nights a week with large attendance and much enthusiasm. This association has had the finest co-operation from its local newspapers and probably gains many members through consistent effort to educate the public as to the value of the amateur men.

Springfield Radio Association.

Mr. F. Clifford Estey, President of the Essex County Radio Association, was entertained recently by members of the Springfield Radio Association in an open meeting held in the club-rooms at 19 Orleans St., (Springfield, Mass.) The subject of Mr. Estey's address was "County Radio Organizations." He spoke at length on the need of getting together and combining the amateurs into one large national body to escape commercialism. In part, his talk was as follows:

"I am well known to all of you as the President of the Essex County Radio Association. Perhaps a few words as to the history of this association are not inappropriate."

The followed an interesting history of the Essex County Radio Association.

"The amateurs in America must get together to live, for big business is falling hard for wireless telephony, and when big business gets hold of a thing, it's hard to make it let go."

Upon request, Mr. Estey then gave a brief outline of the policy of the American Radio and Research Corporation, with which he is connected, and showed several pieces of Amrad apparatus.

Instructor Creaser of the Springfield Radio Association, and President Cushing of the visiting Connecticut Valley Radio Club, of Springfield, then gave brief talks on the advisability of combining Springfield's two radio organizations. It was decided to wait a while before doing this.

State College (N.M.) Radio Club

The State College (New Mexico) Radio Club held its annual dance at the college gymnasium on Nov. 10th. The purpose of this was to get together funds for new equipment for the club, as well as to furnish amusement for the members and their friends. Many novelties were introduced at this event. Perhaps the most striking was the dance programs. These were made from a 5" x 7" photo creased in such a way as to make a four leaf folder with the printed side showing. The print was made from a negative taken from four photographs pasted on cardboard in the proper manner. These photos had been lettered in india ink so that all of the printing on the finished photo appeared over the pictures. The front cover showed a view of the Campus with the Engineering building and its 133 foot mast on the tower. The back cover showed a close-up of one of the club's portable sets ready for business. Inside was a picture of one of the portable sets on last year's military encampment up in the Organ Mountains, and opposite it the Radio Shack at the college.

(Concluded on page 45)



2RK, BROOKLYN

Nearly everyone east of Denver seems to be hearing 2RK, so that we are glad to have a description of it in our pages.

This station is owned and operated by J. Kenneth Hewitt, and is located at 252 Neptune Ave., Brighton Beach. The aerial, a flat-top inverted L, is suspended between two 75-foot one-piece

masts, each of which is supported by two sets of five guy wires. These guys are $\frac{1}{4}$ inch stranded steel cable, broken up into 18-foot lengths by insulators. The spreaders are 18 ft. long and support the four wires of phosphor-bronze, 50 ft. long. Note the insulators which break each antenna wire at the proper length for 200 meters—a stunt which could well be adopted by others whose flat-top length is now too great. The vertical part of the aerial is in the form of a small cage, 10 inches in diameter, of four wires, running straight to the lead-in insulator on the operating room. This keeps the center of capacity high and considerably improves the radiating qualities.

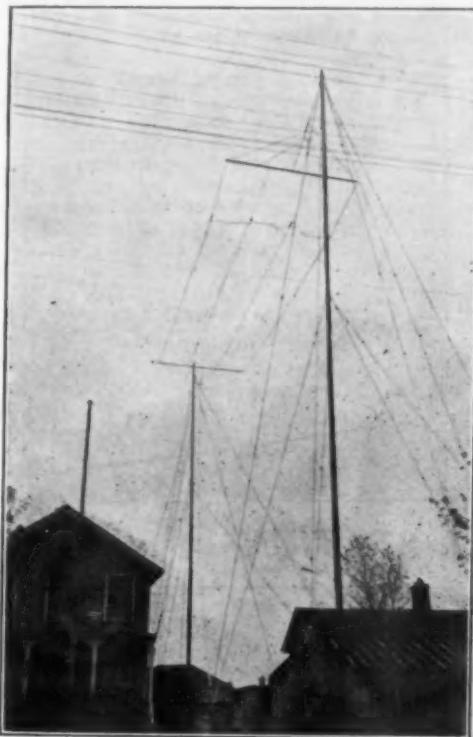
This aerial is used only for transmitting, a single 200-foot wire at right angles being used for receiving, with a break-in hookup, which adds greatly to the operating efficiency.

The station itself is a small specially-built house. The transmitting equipment is located in a pit under the floor, unfortunately making it impossible to get a photograph of it. The apparatus consists of a United Wireless 30,000-volt "coffin" transformer, a Grebe synchronous rotary gap, four Navy Leyden-jar condensers, and a pancake oscillation transformer. Four Dubilier mica condensers in series-multiple are held in readiness as an auxiliary. The

O.T. has 2-inch copper ribbon for the primary, of which less than one full turn is used, and the secondary is 1½-inch ribbon of which three turns are used. A lead of copper tubing runs thru an Electrose bushing in the floor to a Marconi Type R aerial switch. Relay switches



control the power to the transformer and the starting of the rotary gap, so that there is no A.C. wiring on the operating table. The antenna current is 3½ amperes, as indicated on a Western Electric thermo ammeter.



New Records by 2RK

As we go to press, information reaches us of the following additional achievements of 2RK: In December, copied by American ship, New York to London and back, as QSA at 3000 miles as at 250. Copied on Grebe CR-6 on English vessel at Gibraltar, 3200 miles. Reported QSA off Pernambuco, S. A., 3600 miles, on Navy SE-1420, non-regenerative. These are world's DX records for a 200 meter spark, we feel certain.

The regular receiving equipment is a Grebe CR-6, comprising a regenerative set and built-in tube equipment. A Grebe CR-3 and two-step amplifier are used as auxiliary apparatus.

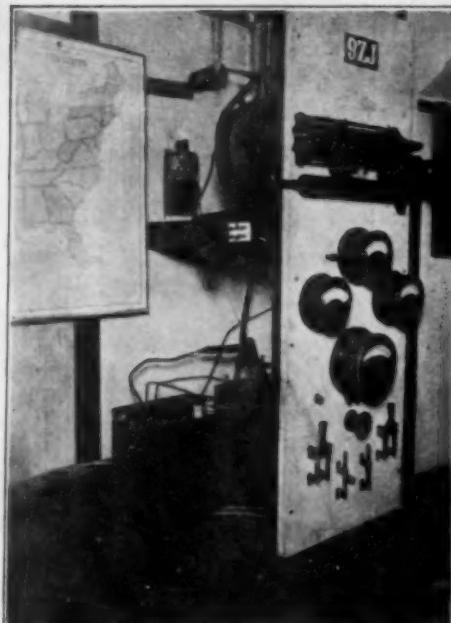
2RK also has a Western Electric CW-936 radio phone. This set, on the front wall above the receiver, is a standard Navy short-wave phone set combining trans-

mitting and receiving equipment, and is fitted with an exterior amplifier of 3 additional steps, shown on the back wall above the operator, and a loud-speaking horn. The dynamotor, operating from a 12-volt storage battery, is located under the table.

We regret we have no photo of Mr. Hewitt. The operator shown is Mr. J. V. Candido of 2RV, who formerly was one of 2RK's operators. Mr. Hewitt will be remembered as pre-war 2AGJ, with a wide reputation for making a set reach out. He tells us there is no mystery in it—that it is simply a matter of being thorough in every detail. It is this thoroughness that makes the difference between a good relay station and a poor one, and 2RK is a good one, for it has worked 5ZA, is QSA in Colorado, and has been heard night after night in Guatemala. 2RK's 3½ amperes are honest ones—they are shown on a thermo-meter—and his wave is decently sharp. The efficient design and construction of his antenna, the high-voltage transformer enabling more power to be put in a 200-meter condenser, and the use of a spark frequency low enough to insure real punch behind every train of waves—these in our opinion are the reasons why 2RK does such excellent work.

9ZJ, INDIANAPOLIS

9ZJ has been heard over two-thirds of the country, so that these photographs will be of particular interest. This station



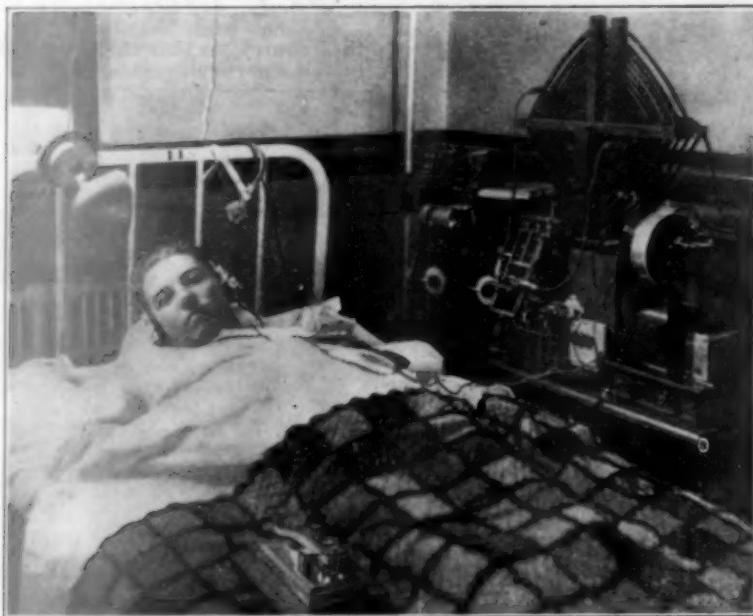
belongs to Mr. F. F. Hamilton, one of our A.R.R.L. Directors, and is devoted principally to experimental and testing work, it being Mr. Hamilton's ambition to standardize and develop transmitting apparatus especially suitable for A.R.R.L. work.

Beginning at the top and working down, the antenna system consists of a 6-wire hexagonal cage 115 ft. long, supported by two masts 88 ft. high. The masts are of black iron pipe in graduated sizes from 3 inches at the top to 7 inches at the bottom, telescoped four feet at each joint thru a reducing coupling and cross-bolted with four $\frac{7}{8}$ in. bolts. The threads were turned out of the smaller ends of the couplings to permit the sleeving, after which the joints were wedged with small steel shims to prevent working, and the joints packed with roof cement to exclude moisture. The masts were erected by setting a 55-ft. wooden pole about 20 ft. from the base of the mast, and rigging two sets of blocks, attached to the center of gravity of the mast and to its top, both blocks being kept moving so as to prevent the masts from bending. They were rigged leaning out from each other about 5 degrees in order to oppose antenna strain.

(Concluded on next page)



AN UNUSUAL STATION



This unusual photograph is of the station of Ed. V. Chapman, Toronto, Canada. Mr. Chapman, a member of our A.R.R.L., has spent nearly five years on

his back, due to a spinal injury, and radio is his only hobby. Needless to say it is a great comfort to him and helps to occupy his time. His set is mounted on a table

convenient to his bed, with everything right at hand.

The receiving apparatus uses DeForest honeycombs and DeForest variable, and contains a detector and two-step amplifier using Moorhead valves. The two headsets are of S. G. Brown make, 8000 ohms per set. NAA has been heard a distance of over 100 feet from the phones, and nearly all of the high powered stations are copied. The transmitter consists of a $\frac{1}{2}$ k.w. Thordarson transformer, $\frac{1}{2}$ k.w. Signal condenser, Murdock rotary, Clapp-Eastham key, and a pan-cake oscillation transformer, compactly arranged and with the change-over and other adjustments where they may be reached easily. The aerial is an inverted L of two wires, 150 ft. long.

We know what a joy and blessing amateur radio must be to this brother member. He would like to hear from other amateurs, and we feel sure some of our number can find time to drop him a line. His address is Ward A, Davisville Military Hospital, Toronto, Ont.

9ZJ, Concluded

They are not guyed, but instead are trussed on three sides and set in concrete 8 ft. deep and 3 ft. diameter. The truss bars, 3 ft. long, are held to the masts by the joint bolts, and the trussing is done with $\frac{1}{8}$ inch messenger cable. The halliards are $\frac{1}{4}$ inch manila rope. The masts and rigging were given two coats of regular bridge paint and a single coat of black auto enamel.

The six antenna wires are paired into three conductors which drop down to about 65 ft., where they form a rat-tail which runs into the building and directly to secondary of the oscillation transformer. The two-wire aerial to the left of the mast is used for receiving.

The sending equipment is mounted on and behind the marble panel shown, and consists of an American 24,000 volt 2 k.w. transformer operated on 200 cycle current; home-made still quenched gap or Bell rotary gap; three units of Dubilier condenser totaling .012 mfd.; and an extremely heavy pancake oscillation transformer. A Western Union key on the operating table actuates an oil break on the floor behind the panel, which controls the current to the transformer and opens the antenna circuit when the key is idle. Kickback preventers are located all over the house lighting circuits and all piping is permanently grounded. The ground lead consists of a one-inch copper tube running directly from the oil break to earth, where it is buried ten feet and connected to city water mains. Additional earthing is provided by zinc plates buried under the sod below the antenna and connected to the copper tube at the ground level.

Three-phase power from city mains at

230 volts operates three motors, one belted to the 200 cycle alternator, another direct-coupled to the 100-450 volt d.c. field exciter, and the third belted to a 300-1500 volt d.c. generator for experimental work. The first two are controlled by push buttons on the operating table.

It was unfortunately impossible to secure a photograph of 9ZJ's receiving equipment, which consists of a Paragon RA-6, a special two-step amplifier, and a vertical loose-coupled 600-18000 meter set equally adapted to regenerative or undamped work. A 100-mile phone set is in operation most of the time but has not yet been built into a panel.

WITH THE AFFILIATED CLUBS

(Concluded from page 41)

The decorations represented the rigging of a ship with its aerial. This was connected to one of the portable sets which, together with a loud talker, gave the crowd a chance to "listen in". All the large stations and many of the amateurs in this section of the country were picked up. The transmitter at the Radio Shack was also in operation, and the radiophone as well, which later relieved the monotony for those that did not know the code. Everybody voted it a great success and is looking forward to the time when it will be repeated.

FRANK CONRAD

(Continued from page 39)

in its earliest stages; there were no suitable instruments for conveniently measuring alternating-current quantities. Early forms of switches, lightning arresters and breakers were being worked upon.

As we look back upon it now, this period seems to have been a wonderful opportunity for the inventor and the environment which could not fail to bring out latent and natural ability. An examination of patents issued to the Westinghouse Company from that time on, shows Mr. Conrad's name so frequently that he should be given high rank among the inventors, upon whose work the business of the Westinghouse Company is based.

He was closely associated with, and later in entire charge of, the arc lamp design. This was his first real engineering work. In this connection considerable work and real advancement of the art was done by him on regulating devices and systems for arc lighting.

One of his latest activities is in connection with the company's radio enterprises when they acquired the International Radio Tel. Co.

The circumstances which led up to Mr. Conrad's becoming identified with radio are rather interesting. It so happened

(Concluded on page 48)

Mr. Henry C. Forbes, Minneapolis, suggests the desirability of an amateur Q signal to refer to our C.W. sets. A fine idea. Let's all adopt this and make it ours like we did "QSS":

QCW? "On what wave shall I listen for your C.W.?"

QCW "Listen for my C.W. on..... meters."

Don't forget QST's Contest for articles on the best relay spark transmitter. It doesn't close until Feb. 15, so there is still time for you to write up how you get results.

Fourteen of us having dinner one night in the Statler dining room during the Midwest Convention were presented with a check for only \$98.21. If we'd had something besides things to eat, that check might not have been so bad. Paragon Paul finally found the loose connection—somebody had one of these stuttering lead pencils which had written \$77 instead of \$7. Only \$70 too much. Really we felt complimented that we looked like that much money.

We hate puns, but if Maxim Silencer would K. B. Warner? This awful one was actually pulled on the Orpheum stage during the St. Louis Convention.

Errata

January QST, page 16, describing Mr. Miller's wave meter coils, reads "No. 10" wire. This should read No. 18 wire.

On page 8 in the January issue an erroneous reference is made to "the instantaneous amperes shown by the antenna current meter". The antenna current meter shows R.M.S. amperes, and in the case under consideration the reading in amperes would be increased (proportional to the square root of the power increase). However, it is true in the example cited that the "instantaneous amperes" will not be increased.

Owens, 9EL, they tell us, has the distinction of having been asked by a small boy thirty miles away to please send time signals and a weather report each night, as 9EL is the only station he hears. Now we appreciate there are very few lulls in the din around 8ZL, for instance, but we

didn't know it was that bad in Kansas.

Mr. A. E. Bessey requests that we correct a rumor that he has a connection with The Radio Shop, San Jose, Cal. Mr. Bessey has a large and growing business of his own which takes up all the time he can spare from A.R.R.L. work. Division Manager Bessey's son, Mr. E. H. Bessey, is a member of the firm of The Radio Shop, which probably caused the confusion.

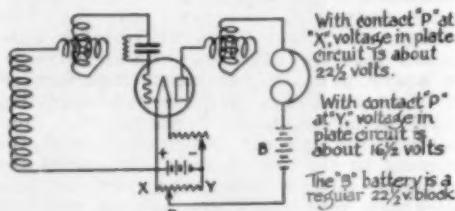
Zeller's (9AU's) modulation is getting pretty good on the dictaphone lately. What kind of bulb does he use?

The Deseret News, Salt Lake City, Utah, have installed a 1 K.W. station with call letters 6ZM, for the purpose of sending a press schedule each night to the amateurs in that section of the country. The transmission starts at 9 o'clock Mountain Time, on 375 meters. 6ZM has an Acme transformer, an oil condenser especially built for the set, Benwood rotary, Western Radio oscillation transformer, and a receiver using honeycombs and a two-step. They are ready and willing to handle A.R.R.L. traffic at any time.

Zee: "Does your grid leak?"

Nith: "No, I've got Neverleak in mine."

2UD sends us this handy kink for getting the correct voltage on the new Radiotrons. With the potentiometer located as shown, the plate voltage may be varied



from about 16 1/2 to 22 1/2 volts without the usual troubles attending the use of a potentiometer. Be sure about the polarities.

A Toronto newspaper displays a cut of the Nauen station building over the title "The most powerful radial station in the world." We can't see where the street cars run in to it, but it may be a good

radial station altho not the world's largest radio station—not since LY and 9ZN started their schedule.

According to a newspaper item, 9BY has a rooster who crowed so loudly over 9BY's radiophone that it awoke the wife of a radio man in Dallas, who got up and started to prepare breakfast. No comment.

8IK, Ashland, Ohio, proudly reports the reception of signals from 6ER, Los Angeles, at 6 a.m. E. S. T., November 28th. We understood 9XM heard 6ER at the same time.

Wondering who KDKA is? Westinghouse Elec. & Mfg. Co., East Pittsburgh, 375 meters.

Has anybody used the G. E. dynatron circuit for C.W. transmission?

New York "World" recently had a very interesting full page of amateur station photographs. But how they get twisted on the radio language. They show one phone station whose call letters they give as "U-R-X-O-M". The reporter probably heard the operator tell somebody "QRX, OM". Oh, well, if he hadn't we'd have been shy a smile this month.

Our Traffic Manager, Geschnell, got busy on his own hook and wrote letters to all the Senators comprising the Committee on Naval Affairs. Among the acknowledgements received was one from Senator Walsh, of Montana, who replied on his letterhead as Chairman of the Senate Committee on Disposition of Useless Papers in the Executive Departments. Hi about that! We can state that in the opinion of about a quarter million amateurs it is altogether fitting and proper that the Poindexter Bill, S-4038, should be referred to Senator Walsh's committee for appropriate disposition. It surely should come under his jurisdiction!

The abbreviation "QSS" is frequently heard now in the commercial game, and the fellow at the other end usually knows what is meant.

Re log systems: most of the commercial companies use a form having three narrow and one wide columns, headed, respectively, "Time", "Station Called", "Called By", and "Remarks". This seems to us a good form for amateurs to follow.

WOULDN'T IT BE WONDERFUL—

If 3GO didn't put a different antenna every Sunday and holiday?

If honeycombs would give tight coupling with exactly even centers?

If some of these fellows with big

antenna currents would measure 'em on a thermo-couple ammeter?

If 3VV would try both feet sometime so DX men could get his call before the 99th time.

If 8XK's buzzer was as loud as his generator hum?

If some of these amateurs, and amateurs-to-be could write so that a printer could read it?—Linotype Dick.

Need a few more "Wonderfuls", fellows.

On Nov. 28th the U. S. Mine Sweeper "Swan" went ashore near Duxbury, Mass., in a terrific northeast gale, and her crew were saved in as sensational a rescue as was ever witnessed on the New England coast. During the trouble and the events which led up to it, the "Swan" was in touch with the Charlestown navy yard, with nearby amateurs as interested listeners. After the "Swan" was aground, she found it impossible to get thru direct with her radio, when 1FBF, Cushing, of Duxbury, jumped into the breach and relayed her message to KQZ, "City of Rome", who in turn forwarded it to the navy yard.

The Somerville Radio Laboratory have an interesting line of apparatus and parts for the C.W. experimenter. One of their specialties is a split-secondary modulation transformer, with half the secondary in the grid circuit and the other half in the plate circuit. They also have an extremely nifty dial and knob combination, suitable for condensers, variometers, etc. The heavy metal dial is 4½" diameter, satin nickelized, with a counter-clockwise scale for clockwise reading in black enamel, with a 2 inch Navy knob. This is a high grade accessory that will add to the appearance of any set. If the dials be grounded they should act as considerable of a shield from capacity effects, and their satin finish takes pencil calibration by call letters OK.

New Books Received: "The Thermionic Vacuum Tube and Its Applications," by H. J. van der Bijl, M. A., Ph. D.; Research Physicist, A. T. & T. Co. and Western Electric Co. Published November, 1920; 391 p.p., 6x9, 232 illustrations.

Despite the importance of vacuum tube development and the extensive literature that has grown up, there has been no authoritative, single textbook dealing comprehensively with the subject.

Dr. van der Bijl has had an exceptional opportunity as research investigator of the Western Electric Co. and the American Telephone and Telegraph Co. to collect data on thermionic vacuum tubes.

His book supplies the first comprehensive and reasonably concise treatment of principles of operation and the more im-

portant phenomena exhibited by the passage of electrons through high vacua.

The first chapters are purposely elementary. Chapter IV discusses the characteristics of the thermionic valve, while the influence of gases in the bulb on the characteristics of the valve is dealt with in Chapter V. The operation and some of the uses of the valve are described in Chapter VI. Chapter VII describes the amplifier, the manner in which it operates and the circuits that can be used. It includes also a treatment of the characteristics of the three-electrode tube. Chapter VIII deals with the efficient operation of a three-electrode tube as an oscillation generator. The processes involved in the detection of electromagnetic waves and in the modulation of high frequency waves are treated together in Chapter IX. In Chapter X a few miscellaneous applications of the thermionic tube are illustrated.

The remarkable ability of thermionic vacuum tubes to perform a great variety of functions has gained for them a wide interest, and consequently this new book will, we believe, find a ready welcome. It is elementary enough to meet the demands of those who are interested in delving into the why and wherefore of tube operation but who are not sufficiently acquainted with electron theory to understand the briefer explanations heretofore published. And from there it covers every phase of tube work in an authoritative manner. We consider it splendid, and can recommend it to anyone desiring a comprehensive text on this subject.

The net postpaid price is \$5.00, available promptly from QST Book Department.

FRANK CONRAD

(Concluded from page 45)

that during the course of a discussion, such as often takes place across the lunch table, one of the engineers displayed a watch he had just bought. This brought on the usual argument which often takes place between friends in such cases, regarding the relative merits of watches. The principals of the argument decided to compare their watches daily with the company's master clock, which is controlled by Western Union Time Service. Mr. Conrad, who by the way, is also an expert in the theory and construction of time pieces, discovered variations which he could only account for on the assumption that there were errors in the Western Union Time Service. This was during the early days of radio when operation by amateurs had not been generally attempted. Mr. Conrad made a rough coil or two, and a condenser, set up a small antenna, and soon he was able to receive the Arlington time service. He still has his watch but

his opponent in the argument traded his for a better one.

To Mr. Conrad, a "hobby" is a study which he makes in an exhaustive manner—whether it be raising gold fish, or studying lower forms of animal life. The accumulated result of all these hobbies is a versatility of experience that is remarkable and unusual.

Thus, radio became his latest hobby and it was not long before he had a radio station, the equal of any in Pittsburgh, on the upper floor of his garage, where he tried new ideas, on many of which he has entered important patent applications.

Then came the War and with it the company's activities in connection with the Navy and War Departments. Mr. Conrad's radio knowledge was a contribution to the winning of the War. His assistance was very highly appreciated by both the Signal Corps, Radio, and the Navy Radio Departments at Washington.

Mr. Conrad has no established specialty, and is not tied to any specific department. He is free to devote his talents where most required. Any technical problem of especial concern is most likely to be referred to him for his opinion and it is an interesting fact that as the various engineers progress in experience and responsibility they show a growing recognition of the value of his advice, by their increasing desire to consult him on important matters and thus take advantage of his broad experience and judgment.

A description of Mr. Conrad's station, 8XK, was published in QST for September, 1920.

THE OPERATING DEPARTMENT

(Concluded from page 38)

station at Chatham, Ontario, is nearing completion.

Toronto has come along well in relaying. The Manager's station 3AB worked steady CW transmission to 8ANJ all through the past month tho only using a few watts, and worked day or night, relaying many messages to and from the United States. The higher powered CW stations at 3AB and 3AC will be in operation, shortly.

THE PACIFIC CONVENTION—Editorial

(Concluded from page 32)

founded—of a non-commercial organization of, by and for the amateurs who compose it—is a really good one, a foundation on the rock!

QST'S DIRECTORY OF CALLS

ADOPTING the Department of Commerce's list of amateur stations as it standard, QST will publish each month the calls of new stations in each district commencing where the government book stops. To make this possible, amateurs are requested to report new or changed call letters to this office.

FIRST DISTRICT

James C. Ramsey, Jr.	36 Kilayth Rd., Brookline, Mass.	(Correction)	1QR
Samuel A. Waite,	49 Benefit St., Worcester, Mass.	IGBA	
Frederick Grindie,	9 Second South St., Bar Harbor, Me.	IGBB	
William E. Arnold,	188 Oliver St., Southbridge, Mass.	IGBC	
George W. Long,	13 Windsor Rd., Somerville, Mass.	IGBD	
Anthony O. Leske,	456 Grafton St., Worcester, Mass.	IGBE	
Allyn R. Beatty,	57 High St., Saco, Me.	IGBF	
Waitt & Sackett,	191 Oxford St., Lynn, Mass.	IGBG	
W. O. Benson,	16 Fern St., Worcester, Mass.	IGBH	
P. Edw. Handy,	Riverside Drive, Augusta, Me.	IGBI	
Alex. J. Kosiel,	15 Elm St., Bristol, Conn.	IGBJ	
M. R. Young,	82 Willow St., Augusta, Me.	IGBK	
John E. Norman,	17 Turket Shore Rd., Ipswich, Mass.	IGBL	
Alfred Korb,	82 Milton Ave., Dorchester, Mass.	IGBM	
Murray Stearns,	20 Center St., Watertown, Mass.	IGBN	
H. L. Isaacson,	155 Retreat Ave., Hartford, Conn.	IGBO	

SECOND DISTRICT

Sidney Kasendorf,	910 Home St., Bronx, N. Y.	2ATV	
L. S. Hirsch,	2981 Briggs Ave., Bronx, N. Y.	2AUE	
I. S. Simpson,	207 Sixth Ave., Brooklyn, N. Y.	2AZJ	
Albert Wilson,	49 Lawrence Ave., Brooklyn, N. Y.	2AZM	
Wm. Cunningham,	266 Pacific St., Jamaica, L. I.	2BAD	
Richard Leitner,	1118 Forest Ave., New York	2BAH	
Sigurd Knudsen,	138 Senator St., Brooklyn, N. Y.	2BAP	
Henry Roth,	53 Lawrence Ave., Brooklyn	2BCD	
Sam'l Kopelson,	251 East 4th St., Brooklyn	2BCF	
Donald Phelps,	716 Ocean Ave., Brooklyn	2BEH	
Hyman Heller,	134 Amboy St., Brooklyn	2BFG	
P. J. Faulkner,	Paterson, N. J.	2BFH	
A. J. Brozzolari,	661 61st St., Brooklyn	2BFP	
A. B. Fisher,	96 Edgewood Ave., Yonkers, N. Y.	2BGD	
Wm. G. Moore,	68 Maolis Ave., Bloomfield, N. J.	2BHT	

THIRD DISTRICT

Wm. S. Creighton,	434 Wash'n Ave., S. W., Roanoke, Va. (Correction)	3RF	
H. A. Snow,	1656 Newton St., N. W., Washington, D. C.	3ZE	
G. P. Hamilton,	108 Pine St., Millville, N. J.	3AA	
L. H. Dunnam,	2375 Champlain St., N. W., Washington, D. C.	3AAO	
R. B. Green,	1004 Hamilton Blvd., Hagerstown, Md.	3AAS	
W. B. Flaherty,	2377 Champlain St., N. W., Washington, D. C.	3ACF	
Kelsey Calkins,	South 4th St., Millville, N. J.	3ADG	
F. W. Mergenthaler,	Collegeville, Pa.	3ADO	
William G. Clamer,	Collegeville, Pa.	3AIA	
F. A. McGarry,	6030 Christian St., West Philadelphia, Pa.	3AKO	
G. P. Weaver,	Camp Hill, Pa.	3AKZ	
J. E. Williams,	Bonsall Ave., Fernwood, Pa.	3ALD	
E. B. Montague,	821 Third St., N. E., Washington, D. C.	3ALR	

FOURTH DISTRICT

Albert W. Parker,	15 Change St., New Bern, N. C.	4EA	
E. H. Brack,	Midville, Ga.	4FD	

FIFTH DISTRICT

John Dorsa,	117 W. 12th St., Dallas, Tex.	5JG	
F. H. Rowland,	P. O. Box 14, Comanche, Tex.	5JX	
Jack Moore,	5015 Ross Ave., Dallas, Tex.	5JY	
G. T. Conner,	500 E. Jefferson Ave., Dallas, Tex.	5KF	
Floyd Williams,	619 W. Hurd St., Edmond, Okla.	5LB	
A. P. Daniel,	2504 Bagby St., Houston, Tex. (Correction—ex 5AO)	5ZX	

SIXTH DISTRICT

Following reassessments; cancel assignments in Call Book:			
N. A. Morgan,	866 82d St., Oakland, Cal.	6FV	
C. A. Peregrine,	1039 Merced Ave., Berkeley, Cal.	6IK	
F. A. Brandis,	116 Polk St., Napa, Cal.	6IY	
J. J. Mahler, Jr.	Los Altos, Cal.	6UB	
E. A. Portal,	223 Cowper St., Palo Alto, Calif.	6HM	

SEVENTH DISTRICT

Following reissued calls; cancel assignments in Call Book:			
E. Sheets & John Julian,	Oak Grove Ore.	7KB	
Billings Polytechnic Inst.	Billings, Mont.	7XD	

EIGHTH DISTRICT

Following reissued calls; cancel assignments in Call Book:			
Jas. E. Penberthy,	486 W. Phila. Ave., Detroit	8DW	
A. H. Benzes, Jr.,	196 Keystone St., Buffalo	8FE	
Detroit Radio Labs.,	3661 Gratiot Ave., Detroit	8GZ	
W. T. Pasanen,	21 Lamson Pl., Detroit	8HQ	

W. Weaver, Jr.,
Robt. Palmer,
D. A. Hoffman,
Following are new calls:
Paul N. Elving,
Samuel F. Kruper,
Jack McKinley,
Dale K. Auck,
Paul Woodward,
Glenn A. Walde,
Phillip Schwartz,
Wm. B. Wines,
Fred Kucklick,
Charles F. Sarver, Jr.,
Irl M. Chambers,
Edw. A. Musser,
Louis Karnok,
Carl F. Woese,
Gustaf W. Norling,
Robert C. Bohannan,
Albro Harper,
Thomas Sage,
Harry E. Fitch,
Harry W. Lewton,
Paul T. Criswell,
Wm. G. McKenzie,
C. G. Chapel,
Francis N. Kryszewski,
Moncreif A. Spear,
Karl A. Helman,
M. Crosby Bartlett,
John D. Bohannan,
John McFarren,
Robert Steiner,
Henry J. Partridge,
Howard Mattes,
F. Ray Spindler,
R. Milton Turrell,
Wm. D. Myers,
Edw. H. Cox,
Luther J. Kovalik,
Fred M. Wargowsky,
John H. Dande,
John Aitkenhead,
Annunciation High School,
James M. Boyer,
Frank W. Day,
Olin McPherson,
Guy C. Sudborough,
Glen M. Cornell,
Robert J. Beatty,
Willis H. Farnum,
Raymond E. Corts,
Daniel L. O'Hair,
Carlos E. Brewer,
Geo. S. Hussey,
Kenneth Steward,
Arthur C. Wrigley,
John W. Bankhurst,
Roy E. Sloyer,
Herman H. Lipman,
Clyde Hillman,
John Lukasko,
W. B. McQuiston,
Sam Workman,
Marion A. Mead,
H. Hartwell Hurd,
Michigan Agricultural College,
C. W. Wargoner, West Va. Univ.,
Geo. Carter, Junior College,
Ohio Wesleyan Univ.,

619 Church St., Ann Arbor, Mich.	SHO
6050 Northfield Ave., Detroit	SPY
50 S. Balch St., Akron, Ohio	SUX
1228 Sunday St., N. S., Pittsburgh, Pa.	SAJM
Amyville P. O., Gratztown, Pa.	SAJN
Box 1044, Uniontown, Pa.	SAJP
141 W. 11th Ave., Columbus, O.	SAJQ
237 E. Main St., Kent, Ohio	SAJR
223 S. Union St., Salem, Ohio	SAJS
218 Grant St., Washington, Pa.	SAJT
1208 Hill St., Ann Arbor, Mich.	SAJU
622 Vine St., Coshocton, Ohio	SAJV
3280 Orleans St., Pittsburgh, Pa.	SAJW
37 Montrose Ave., Delaware, Ohio	SAJX
711 Pearl St., Wapakoneta, Ohio	SAJY
2759 McCurdy Ave., Cleveland, Ohio	SAJZ
802 McBride St., Syracuse, N. Y.	SAKA
Buffalo St., Freeport, Pa.	SAKB
173 E. Hudson St., Columbus, Ohio	SAKC
R. D. No. 1, Niles, Ohio	SAKD
2001 E. Jefferson, Detroit, Mich.	SAKE
219 W. Church St., Elmira, N. Y.	SAKF
3227 West 56th St., Cleveland, Ohio	SAKG
107 Farragut St., Vandergrift, Pa.	SAKH
3712 Mifflin St., Pittsburgh, Pa.	SAKI
430 Almyra Ave., Youngstown, Ohio	SAKJ
1319 North St., Rochester, N. Y.	SAKK
539 Wheeler Ave., Scranton, Pa.	SAKL
2437 East 82nd St., Cleveland, Ohio	SAKN
226 Burns St., Detroit, Mich.	SAKO
226 16th Ave., Columbus, Ohio	SAKP
1215 Chislet St., Pittsburgh, Pa.	SAKR
1050 Trumbull Ave., Detroit, Mich.	SAKS
135 Broadway, Dover, Ohio	SAKT
189 Avenue B, Rochester, N. Y.	SAKU
1762 St. Paul St., Rochester, N. Y.	SAKV
506 Broadway, Harrison, Ohio	SAKX
190 Franklin Ave., Vandergrift, Pa.	SAKY
9 Pierce Ave., Hamburg, N. Y.	SAKZ
322 Hunter St., Niles, Ohio	SAALA
1021 9th St., Port Huron, Ohio	SAALB
462 Carey Ave., Wilkes Barre, Pa.	SAALC
162 N. Portage Path, Akron, Ohio	SAALD
Parkview & Jefferson, Detroit, Mich	SALE
6116 Howe St., Pittsburgh, Pa.	SALP
111 E. Sandusky St., Findlay, Ohio	SALG
2510 Grand Ave., Parkersburg, W. V.	SA LH
White Pigeon, Mich.	SA LI
16 Elizabeth St., Hudson Falls, N. Y.	SA LJ
36 N. Monroe Ave., Columbus, Ohio	SA LK
17 Atkinson St., Rochester, N. Y.	SA LL
243 May St., Buffalo, N. Y.	SA LM
93 East 7th St., Oswego, N. Y.	SA LN
185 Harker St., Mansfield, Ohio	SA LO
127 East 3rd St., Cincinnati, Ohio	SA LP
314 S. Vine St., Van Wert, Ohio	SA LQ
R. D. No. 1, Venetia, Pa.	SA LR
Damascus Road, Salem, Ohio	SA LS
308 Monroe St., Kalamazoo, Mich.	SA LT
758 Allegheny Ave., Oakmont, Pa.	SA LU
2800 Veteran St., Pittsburgh, Pa.	SA LV
1318½ Halsey Pl., Pittsburgh, Pa.	SA LW
6315 Bartlett St., Pittsburgh, Pa.	SA LY
731 E. Maiden St., Washington, Pa.	SY G
High St., Savannah, N. Y.	SY H
914 Greyton Road, Cleveland Heights, Ohio	SY J
East Lansing, Mich.	SY K
Morgantown, W. Va.	NINTH DISTRICT
Detroit, Mich.	9DT
Delaware, Ohio	9KA
Broadview Seminary (F. Johnson), La Grange, Ill. (Re-issued)	9AMZ
Theo. C. Combs,	9ANF
E. W. Kimbark,	9AOB
H. C. Harvey & "YM" Haynes,	9AOY
C. F. Kramer,	9APW
R. L. Coe,	9APY
J. A. Callanan,	9ARU
M. G. Goldberg,	9AUB
Robt. Tucker,	9AUO
D. A. Downard,	9AVP
Chas. Lampel,	9AVS
Allan Mallory,	9AWO
Willard McCulla,	9AXU
A. S. Grossman,	
Harold Palin,	
Erwin Ahrens,	

David City, Nebr.
414 E. Pearl St., Lebanon, Ind.
607 Linden Ave., Clayton, Mo.
819 Lawrence Ave., Chicago
711 Dayton Ave., St. Paul, Minn.
1516 S. Lawrence Ave., Wichita, Kan.
582 No. 26th St., Louisville, Ky.
135 W. Ray St., Indianapolis
1144 University Ave., Wichita, Kan.
481 No. Sheridan Rd., Waukegan, Ill.
3968 Wolff St., Denver, Colo.
146 W. 38th St., Indianapolis
1509 Crawford St., Boone, Iowa

Radio Communications by the Amateurs

* THE PUBLISHERS OF QST ASSUME NO RESPONSIBILITY FOR THE STATEMENTS MADE HEREIN BY CORRESPONDENTS * * *



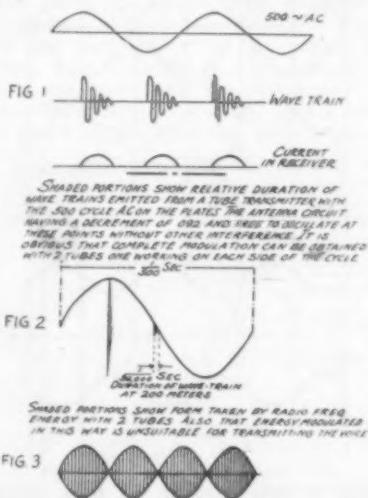
RE A.C. PLATE C.W. SETS

**1322 Kearney St. N. E.,
Washington, D. C.**

Editor, QST:—

1. My interest in experimental radio prompts me to produce some interesting facts in contradiction to some parts of your article on A.C. plate, C.W. sets, in the December QST.

2. My first point of attack is to call your attention to the misconception among radio men of the frequency of the note received from radio sets. It seems to be common practice to speak of the received note from a 500 cycle spark set as 500 cycle pitch while in reality it is a 1000 cycle note. The explanation is easy. For each alternation of current from a 500 cycle alternator (if the set is properly adjusted) a wave train is launched, Fig. 1, and for each wavetrain the receiver diaphragms receive one impulse causing them to pass thru a cycle of mechanical



motion. The frequency of the received impulses, therefore, is one cycle per alternation or 1000 cycles per second. With the A.C. plate tube transmitter using one tube and one half of the cycle, one spurt of energy will be sent forth for each cycle; therefore, 60 cycle supply will give a 60 cycle note at a receiving station. Two

tubes, one working on each side of the cycle will give a 120 cycle note.

3. What about this poor modulation with two tubes? If the grids are conductively connected to their filaments by proper leaks as per the diagrams, and in a similar manner to that of a regular C.W. set, why the accumulation of a high negative charge, taking a relatively long time interval to leak off? If such were the case, the sets would not oscillate during the time that the high charge is present and this very principle is taken advantage of in grid modulation and straight C.W. sets by placing the key or the secondary of the microphone transformer in the grid lead. In a straight C.W. set the charge leaks off at a frequency equivalent to 200 meters or less. Why not at the rate of 60 cycles? The charge on the grid in such a set is not a value due to accumulation but is a series of values, first plus and then minus, impressed upon it from the plate circuit via the grid coupling.

4. Now for the wave trains that persist with the damping of the antenna. Suppose, suddenly, the source of energy was removed leaving the antenna circuit free to oscillate at 200 meters and at a decrement of .092. How long would the resultant wave train exist relative to 500 cycle supply? Take a look at Fig. 2. The shaded portions show the relative duration and amplitudes of two wave trains launched at different points. It is obvious that no wave trains with any considerable amplitude would carry past the zero points between alternations. In actual operation, however, the action is still better for the energy is not radiated as a series of overlapping wave trains. It is actual spurts of sinusoidal C.W. energy of varying amplitude and the decrement is practically zero, so that complete modulation is obtained with two tubes, one working on each side of the cycle.

5. For the last point of attack. Is energy radiated in 60 or 500 cycle spurts suitable for transmission of the voice, when the voice modulates its carrier energy at an average frequency of 1000 cycles? Take a look at the form taken by energy from a set with A.C. on the plate, Fig. 3, and tell me what becomes of the voice at the points of zero energy. Alas! It is lost.

6. Why give the radio enthusiast a

wrong steer at the beginning of a new and promising field?

Sincerely your subscriber,
W. Hollis Hoffman.

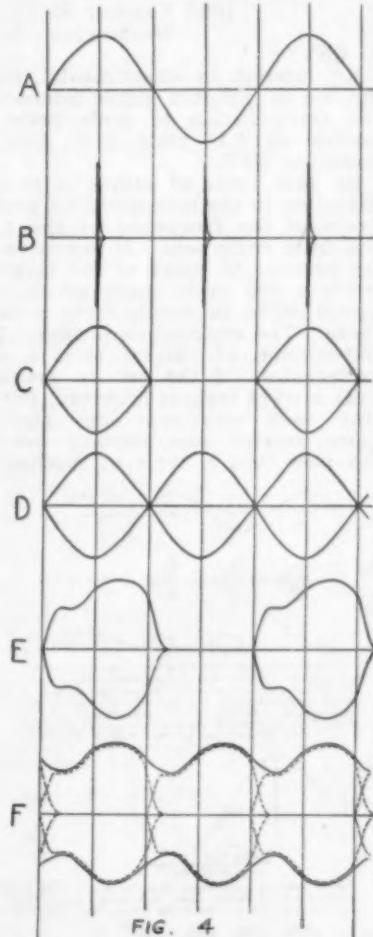
Editor's Comment—Our correspondent's interesting letter gives us a welcome opportunity to unburden ourselves on several phases of this subject.

Strictly speaking, we were in error in mentioning the tone received from one-half of a 60 cycle wave as a "30 cycle note". It was done intentionally, however, our desire being to convey the idea that the tone resulting from such a set would be similar to that obtained from a fixed gap spark set operating on 30 cycle current instead of 60 cycle.

In his third paragraph Mr. Hoffman has misinterpreted our article. Our reference to the time interval between trains during which the charge leaked off the grid had reference to the detector tube, not the transmitting bulbs. Perhaps we can make ourselves clearer. Referring to Fig. 4, A represents a 500-cycle sine-wave voltage which will here be used with reference to both spark and C.W. B represents the envelope forms of a synchronous spark set operating on the voltage A. If the wave length is 200 meters and the decrement so low that there are 50 oscillations in the train, the entire train will have consumed $1/30,000$ of a second, while the trains are $1/1,000$ of a second apart, giving an interval between trains 29 times the length of the train itself. During this time the accumulated charge on a detector grid leaks off. It is true that if the transmitting antenna were suddenly charged and permitted to oscillate at its own damping, the wave form would be as Mr. Hoffman shows in Fig. 2, but in the case of C.W. sets using A.C. on the plate we will have an impressed positive potential during an entire half cycle and can expect the envelope to be somewhat after the fashion of C in Fig. 4—existing for the entire half cycle. Now note that the time interval between trains is not longer than the actual duration of the train. Using two tubes and employing both halves of the cycle we might expect an output envelope similar to D, in which case the time interval between trains is zero. Our point was that ordinary detector tubes with leaky condensers are not designed to work under such conditions, and that better non-oscillating reception would be obtained from C than from D.

The above presumes that the tubes will oscillate over the entire range of instantaneous voltages, which is questionable. If they will not, there will actually be an interval between trains, but we still point out that the output is better suited for heterodyne reception than non-oscillating.

However, Mr. Hull's paper, No. 381 of the Bureau of Standards, cites that in the case of a sinusoidal voltage as at A, the output envelope is not of the form shown at C, but rather of the peculiar characteristic shown at E, the exact reasons for which are not known. It will be noted that even after the zero point is reached in the exciting potential, radiation continues, "the wave train persisting with the damping of the antenna after the tube has ceased to supply power to the antenna." This is logical—the antenna is charged.



Going a step further we may presume with some plausibility that the use of both halves of a sine voltage on two tubes working on either side of the cycle will give us an output envelope shown by the dotted curves of F, which, added graphically, will give a resultant somewhat similar to the full curve of F. This, it will be apparent, is a far cry from the completely modulated

output of Mr. Hoffman's Fig. 3, and obviously better suited for heterodyne reception than non-oscillating. So much for his fourth paragraph.

The Editor has never seen a radiophone operating with A.C. on the plates, but that is no sign that it can't be done. We believe it can. The modulation in F of Fig. 4 is far from 100%. In a set of this kind at the Radio Corporation of America at Aldene, N. J., we understand the "supply modulation" has been reduced to about 30% simply by utilizing the reactive properties of large chokes. Speech of some fashion can be transmitted even under such circumstance as that, and with improvement in the ironing-out process it can be made wholly practicable.

We reiterate our belief that the D.C. generator will be outgrown in Amateur C.W.—K.B.W.

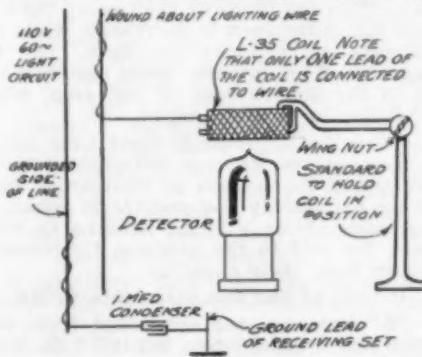
ELIMINATING INDUCTION

721 E. Kingsley St.,
Detroit, Mich.

Editor, QST—

Here goes to clutter up your editorial sanctum with another hook-up. Prepare to add one more to the million or so. This is to eliminate our old friend power, or rather lighting line, induction. It is my great joy to have my long one-wire receiving aerial paralleled for thirty feet by the lighting wires from the distributing pole in the alley.

The hook-up below will illustrate the idea better than I can tell it. There is only one connection to the receiving set proper, and that is to the ground lead. Don't ask me how the blooming thing works, but it does. I think that I have an idea but I won't theorize as I would only



get my bulbs jammed. The main idea is to place the honeycomb coil in such a position that it comes over the detector bulb. By moving it up and down while listening in, some spot will be found at which the hum of the light line is eliminated (about an inch above bulb in my

case). The condenser used is an old 1 mfd. telephone condenser.

If any amateur gets results with this method or has anything to better it, I would like to hear from him, as this induction is second only to QRN at my shack.

Yours truly,
G. E. Mears.

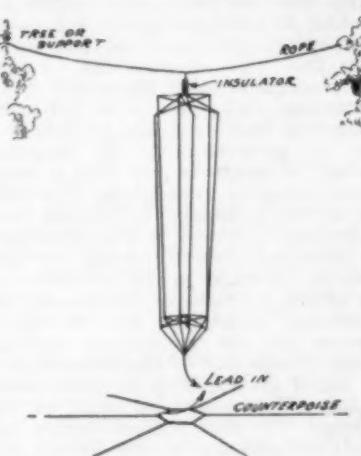
COMMENT ON MR. PHELPS' LETTER RE FAN AERIALS

2020 First St., N. W.,
Washington, D. C.

Editor, QST:

I have studied the aerial system suggested by Mr. Phelps in the November QST and have come to the conclusion that he has not quite hit the mark.

We all strive for a high total current in the aerial. To get this we must cut down the resistance by having equal current distribution thruout the antenna system. Mr. Phelps has not taken into consideration the skin effect, due to the group of wires in one plane, which will cause more current to flow in the outer wires than in those nearer the center.



This effect is caused by the mutual inductance of the wires of the fan, the outer wires being subjected to less induced counter emf than those nearer the center. Consequently, the fan has a higher resistance and the total current is cut down.

None of the three remedies suggested by Mr. Phelps would overcome this difficulty. I agree that all of the wires should be of the same length and also partially agree with the two-wire-diverging-upward antenna suggested by Mr. West. However, the average amateur is not able to get the great height which Mr. West's antenna calls for. Why not, then, construct an antenna combining these features. It is

not as hard as intimated and certainly should be even more efficient.

An inverted cone or conical cage will have all of the wires equal in length, will have equal current distribution with the corresponding decrease in resistance, and will be nothing more or less than several of Mr. West's two wire fans having coincident axes and meeting each other at equal angles. Such an antenna has the added advantage of being symmetrically placed with respect to the ground and makes it possible to build a counterpoise symmetrically about the base.

The illustration may make this a bit clearer.

Very truly yours,
Harry L. Strang, 3IL.

1322 Kearney St. N. E.,
Washington, D. C.

Editor, QST:

I venture to comment on the letter of Mr. Phelps regarding fan antennae.

I have noted with interest the excellent results reported at various times by the users and enthusiastic promoters of this type antenna and without any attempt to in any way discredit their claims am responding to your invitation for comments by pointing out at least one condition where this type antenna can be made to fill a place that other types will not.

Granting 9ZT that it is probably advantageous and desirable to follow out a plan of proportioning of lengths and spacing, it seems to me that a more important issue in determining the effectiveness of the system as a radiator has been overlooked. One of the factors on which the received current from an antenna depends directly is its effective height. The effective height of an antenna system, I believe, is defined not as the upper extreme of the conductors but as the center of capacity of the elevated network. An aerial system may be considered as a condenser plate of area equal to the area enclosed by the outside wires, and the center of capacity as the center point of this area. It is obvious that with two poles of a given height a higher center of capacity can be obtained by means of a flat top than by the fan arrangement. Usually the amateur and experimenter are limited in their facilities for erecting and maintaining supports in excess of from 50 to 60 feet, but when some of the more fortunate are blessed with some form of support at a height of 100 feet or more they are faced with the problem of keeping within 200 meter limits if the full height of the supports is taken advantage of. Here is where the fan type antenna comes into its own and offers a splendid opportunity to get a system of relatively large capacity and a center of capacity of

good height.

Remembering that the current which can be forced into a condenser at a given voltage increases with the capacity, and that the greater the amount of space that can be stressed by the radio frequency potentials, the more powerful are the waves that are radiated, it will be seen that an aerial system of largest capacity available within reasonable limits is desirable.

Now, let's move the capacity out of the limelight, and see if there are not good reasons for more than two wires in the fan arrangement.

Considering the antenna to be free to oscillate at the period to which it is tuned without undue interference from the primary circuit of the oscillating transformer, which is the case where a good gap and loose coupling is used, the main factor that determines the sharpness of resonance in the antenna circuit is its resistance. The greater the resistance the broader the peak of the resonance curve and the less sharply tuned will be the radiated signals.

I cannot see how the addition of wires in a fan to a reasonable spacing would seriously affect the high frequency resistance and they would certainly decrease the D.C. resistance. I think it quite safe then to state that their addition should not prevent the antenna from being tuned to a degree of sharpness comparing favorably with only two wires.

There is another and better quality of several wires vs. two wires in this arrangement for when a wire is strung up vertically from the earth to a height of 100 feet or more, its inductance adds to its capacity and as each additional wire is put into the fan within the limits of the two on the outside the inductance is decreased, while the increase in capacity is slight, for the capacity of an antenna varies approximately as the square root of the area, which in this case is not changed.

I had the opportunity some time ago to make measurements on different antennae erected at the Bureau of Standards, which bring out plainly the manner in which inductance of leads to an antenna or wires in a fan add to the antenna fundamental faster than their capacity.

Details of the measurements follow:

"L" antenna, one down-lead from each wire and formed into a rat-tail 3 ft. below the flat top.

Masts, 102 ft. high.

Masts, distance between, 100 ft.

Antenna approximately, 95 ft. high.

Flat top, 75 ft. long.

Fundamental wavelength, 294 meters.

Capacity, .000635 mfds.

H. F. resistance, 7.5 ohms at 340 meters.

Same as above with single wire down-lead.

Fundamental wavelength, 311 meters.

H. F. resistance, 9.3 ohms at 355 meters.

Fan antenna, 5 wires formed into a rat-tail 50 ft. from the top.

Masts, 102 ft. high.

Fan spread at top, 60 ft.

Fan height at top, 95 ft.

Fan number of wires, 5

Fundamental wavelength, 225 meters.

Capacity, .00049 mfd's.

Same as above with 9 wires in place of 5 and distance from top to where wires form rat-tail, 65 ft.

Fundamental wavelength, 205 meters.

Capacity, .000621 mfd's.

H. F. resistance, 7 ohms at 283 meters.

The latter data on the fan type antenna show how the full height of the 100 ft. masts was taken advantage of, keeping the fundamental wavelength at 205 meters against the 294 meters fundamental of an "L" type on the same masts.

One last comment on the fan. Let the point where the wires are rat-tailed together be as far above the earth as possible and still retain the desired capacity, so that the center of capacity of the network will be well aloft.

In conclusion, would make this classification:— Flat top antennae for low supports and fan antennae for the high ones.

Yours truly,
W. Hollis Hoffman.

416 Court House,
Minneapolis, Minn.

Editor, QST:

As far as I have been able to determine the general consensus of opinion seems to be in favor of what I wrote in my last letter in November QST dealing with Fan Aerials. This was not a comparison of the fan with any other type, as some have considered it, but just a suggested improvement on the fan as it is commonly constructed to-day. I left the choice of types entirely up to the individual depending upon his local conditions. This phase of the subject is covered in the excellent letter from Mr. Hoffman.

In the letter from Mr. Strang he says I neglected the skin effect and that more current flows on the outside wires. Well, what of it? If you made a two wire vertical fan with the wires widely diverging and then added more wires between, it is true the skin effect would be more but the current in the outside wires would be somewhat less for the same current input. I don't see how simply equality in current distribution cuts down the resistance. The skin or "self-

repulsive" effect is not desirable but by bringing nearer together all the wires of a fan and making a vertical cage with equal current in each wire, its use as an antenna has depreciated. Except for increased conductivity, I do not believe a cage antenna much better than a single wire unless the cage is made quite large. Furthermore, the center of capacity of a vertical cage is lower than that of a fan on the same supports. If made conical to any great extent it would require many towers, which would be out of the question.

Mr. Hoffman's letter covers the choice of types of antenna and the factors that go to make up its fundamental wave length in a manner we have been looking for. His experimental data is most interesting and convincing and the only comment I have is, "Why didn't someone give us this dope before?"

It is hard to say what an amateur station will look like in twenty-five years from now but it is certain many things we have now will be obsolete. If my last letter had been entirely in the wrong I would have considered it of some value if it had set amateurs to thinking. Those letters from Mr. West and Mr. Washington caused more searching after technical information among amateurs than anything I have seen for quite a while. Let's have some more like that.

With the best of 73's,
Boyd Phelps.

Brooke, Va.

Editor, QST:

I note a letter from Mr. Phelps in the November QST on aerial design, and while I am not much a believer in "theory" as applied to amateur radio, Mr. Phelps' arguments are certainly good and worth considering by anyone using the fan type of aerial.

I cannot speak for or against any type of aerial when it comes to transmitting, but for receiving the aerial certainly plays an important part, and regardless of theory or what others may say I am firmly convinced that an aerial with a natural period far in excess of 200 meters will bring in more and stronger signals than aerials whose natural period is 200 meters or less. As I have stated before the height plays an important part in selecting various localities and an aerial may be so designed that stations close to you will be heard very indifferently, while distant stations will come through in grand shape. This situation can be reversed by a change in the aerial, but it should be understood that what will give one result at one station may give the reverse at another in a different locality and the only thing to do is to try out different aerials until the desired results are obtained.

However, we are all desirous of receiving as many stations as possible and hardly wish to give up one group to receive another group. We are all more or less familiar with the fact that an inclined wire will receive from stations in the direction of its inclination many times better than from any other direction, and that the longer the wire the greater the directional effect; or stated in another way, the more gradual the incline of the wire the greater the directional effect. To the best of my belief this principle is one of the causes of the popularity of the vertical fan aerial today for amateur use, as usually the fan aerial is not truly vertical but has an inclination in one direction and the separate wires are also inclined, depending upon the distance between poles, giving three general directions of inclination—or two if the aerial happens to be a true vertical one.

It appears to me, and my beliefs stand up remarkably well in actual results received, that we could turn this fan aerial upside down and add a few more wires, making the umbrella type of aerial. This type of aerial only requires one tall mast instead of two for any other type. There is very little strain on it, reducing the chances of a breakdown, as the aerial wires themselves act as supports. If the wires are long the directional effect is quite pronounced and 8 wires radiating from the mast in different directions should make an aerial capable of receiving from practically all directions with equal ease.

Furthermore it appears from experience that the 8 wires should not be spaced equal distances apart but should run in pairs, each pair being separated some distance at their base, with their base connected together just like any other free end aerial. This in effect would give four two-wire aerials (providing the leads are brought in separately) each aerial being best suited for receiving signals from the direction of its lowest end. A switching arrangement to cut in all or any of these separate aerials for different directional effects should go a long way towards a simple selective system for stations in different directions.

The principle of receiving with this type of aerial is on the same order as described by Mr. Mathews on page 14 of the June 1920 QST insofar as the directional effects are concerned.

After considerable trial experiments I am convinced an aerial of this kind is very suitable for general reception and am arranging to erect a permanent aerial of this type some 80 feet high and will let you hear what results are obtained with it.

Sincerely,
A. L. Groves.

DO THEY HAVE QRW IN ELMIRA?

Dear Editor QST:

Will you pleas print this O'bichary notis in your valuable magazin in the want colom like "Whose Who"?

I was over to Elmira the other evenin to the Amateure show called "Ho Ho Cindy" and their was a performer in the show, the Stage Manager, who called himself Mr. Hulligan or somethin like that.

Well, when the curtain riz, the scene was like the Amsterdam Theter in NYC and full of show girls. Some of 'em were chewing gum and chewing the rag with each other and this Manager did a lot of cussing and shuting at them 'cause they wernt actin right.



L. O. Adams, 8QM

Now I was trying to see whether he wasn't reeley Irish or not cause his note and pitch (gab) sounded like he was to me. So I looked on my programm to see who the guy was. Well, cross the page oposite the Stage Manager it said "Louis Adams", so reckoned it was his real name. Spouse his folks was called O'Adams before they kum across. Gee, he is gettin high-toned (Clapp-Eastham), so he drops the O. Now if that's the case Ide call him pretty poor Patch Irish, for I'm Irish and proud of it to. "O" for me every time. And "Oh! Oh! Cindy".

Reckon, Mr. Editor, if you'd seen that

show you'd say he was some actor. Pretty soon he came out on the stage looking like the picture I am sendin you in the mail marked X in the score card.

Then he was called a Fairy God-Mother on the bill of fair. Hully Gee, you should have seen him; looked like anything to me but a mother. His part as a God-Mother was full of action from start to finish. Spose the man what wrot the show made it that way so he wouldn't catch cold.

There were two girls sat right in front of me and they were makin all sorts of remarks about the actors and their actin. One said to the other, "Isn't he just swell?" "S-W-E-L-L?", said the other, Actin' or figure do you mean? Look at them legs; bet he escaped from the Hunger Strikers; wonder who he is any way." "That's Adams, the individual auto mechanic" said a man on her left. Then he added, "He's the man what hears wireless music in the papers."

Now bein' somewhat of a wireless bug myself, that sat me thinking. Reckon, then, he makes his money taking the rattles out of Tin Lizzies to spend wirelessing.

After the show was over, me and my friend sat out to see the village and wound up with a After-Theater Party so it was pretty late when I got back home. Reckon Ide better said early; guss my watch had stopped, as it does some times when the town is too slow. Might have been the cold.

Well, anyway, I was late to work the next morning, and what the boss said to me wouldn't look good in print. I tried to tell him my watch had stopped, and he chirped out "Spose you set it by wireless."

So next night I just sat down to cut in for NAA time sigs (didn't want to get another balling out) and first thing I heard was CQ CQ CQ CQ CQ CQ CQ CQ de 8QM 8QM right thru time signals too. You see my watch was slow. Nuthin the matter of the watch? I forgot to wind it is all. Say he is built on broad lines (his picture don't look it) for you can get him anywhere from 200 to 13000 meters.

I looked him up in the call book and it's the same feller you hear C---Q---ing every night, only he's put his name in the show sheet "Louis" and in the book "Lucius". Might be the printers fault, might be he was making an alaby 'cause he felt a little timid about folks seeing him dressed that way.

We fellows over here (we are not over thirty-five miles from Elmira) decided you'd be glad to show his picture to the boys so theyd know whose who when they heard him.

Say he must be a regular angel. First, cause he is always up in the air. Second, he is always harping on something. Third, he hasn't any clothes. (At least not many

in the picture.)

The gang have taken up a collection to buy him a buzzer set to practice on but dont want to hurt his feelings so we arnt going to send it. He might think it a bit suggestive.

Sig.

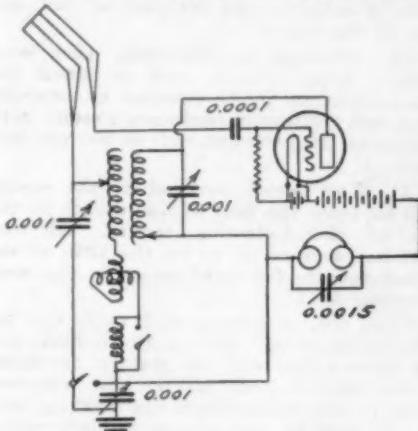
Pat McCrittick.

AN UNUSUAL HOOKUP

Apartado 7,
LaBarca, Jal., Mex.

Editor, QST—

I attach a circuit which differs from the ordinary in the connection to grid from the extreme end of the antenna, where the



potential is highest. I have never seen this circuit published. It is particularly sensitive to continuous waves.

Sincerely yours,
Julio Prieto.

THE NUT WITH THE BUG

Walnut Grove, Cal.

Dear Eddie:—

Fellows you can all talk about QRM and its various causes but you have left out the fellow who has a bug, the use for which he never knew, and pacifies himself polluting the ether with mush that he or no one else could ever read. The bug is half the cause of a station calling his friend around the corner ten or more times and signing about that many more, with no less than a half to a one K.W. going out. When a ham starts up the first thing he usually gets is a bug key, and what's more he wants the whole country to know it. Listen to the L.D. fellows and see how many make use of them, although the bug in the hands of a real operator sounds very well. The bug has its place but in the majority of cases it's not in the amateur radio field.

73OM CUL,
J. W. Wise.

CALLS HEARD

To increase the value of this department of our QST we will henceforth print more "Calls Heard" and adopt a policy that will result in those printed being fresher and more representative lists. Our members are asked to carefully follow these instructions in reporting calls:

(1) Typewrite or neatly print the calls, "double-spaced", on a separate sheet of paper, running them across the sheet, not down a column, and writing on but one side of the paper.

(2) Arrange alphabetically thru each district, from 1 to 9, with no break between districts, using commas to separate items and putting parentheses around calls of stations also worked—all as per the lists below.

(3) The period covered by the report shall be from the first of one month to the first of the following month. All lists must be received by us by the 10th of the second month, for publication in the next following QST.

If you will co-operate with us in this, no calls published will be over two months old, and their value will be greatly increased in that we can keep tab on how improvements in our transmitters are working out, etc. It will be our aim to publish representative lists, equally distributed over the country; and in general to conduct this department so as to be of the highest possible service.

We are awfully sorry, fellows, that we can't print all the lists received, but it just can't be done. We know what a job it is to get up a list, and we certainly appreciate your kindness. Now help us to get them published by making yours comply with the requirements. We will be obliged to disregard any that do not follow instructions—in fairness to the other fellow.

We thank you.

HEARD AT SEA

WKOU reports, 100 miles south of Tampico, Mex., Dec. 22 to Jan. 6: 2RK, 3VV, 5BI, 5BM, 5CA, 5CG, 5ED, 5EJ, 5EF, 5ER, 5ES, 5EW, (5DW), 5CM, (5FL) 5FR, 5GC, 5HY, 5HL, 5IR, 5IS, 5JA, 5JB, 5JD, 5JG, 5JN, 5JI, 5JX, 5ON, 5YH, 5ZA, (5ZC), 5ZF, 5ZG, 5ZK, 5ZL, 5ZP, 5ZS, 5ZX, 5XA, 8FT, 8XK C.W., 8ZR, 8ZY, 9AP, 9CA, 9EE, 9EQ, 9FU, 9HI, 9HR, 9JN, 9KO, 9KV, 9LM, 9LQ, 9LR, 9MC, 9NJ, 9OE, 9OR, 9OX, 9ZB, 9ZC, 9ZW, (9HN), 9AAC, 9AEG, 9AEQ, (5ZU).

KUNC heard 3VV, 8DI, 8ZY, 9JQ, in Mobile harbor on galena, Nov. 18.

KULL on Oct. 28, off north Florida, reported SDX, SNI, SDI, 1HAA, 1AW, 9LR calling 8DI.

Ex-6HL off Nicaragua, 1400 miles south New Orleans, Dec. 9, 5ZC, 5AQ, 5XA, 5BJ, 5EJ, 5BM, 5ZP, 5JA, BCO, 9LR.

Operator S.S. "William Green", Tampico, Nev. 18, 9LR, 9AEG, 9AKC, 9HI, 9RV, 5XD, 5YH, 5ZN, 5ZA, 5FL, 5BI, 5ZC, 5BC, 5DW, 5GA, 5ZP, 5CG, 5XA. Dec. 3, lat. 4°00'00" n., long. 42°25' w. (2712 m. from New York): 2RK. While 150 m. north of Orinoco River, 9AEG very QSA. While 200 m. east of Trinidad, 9AEG, NSF, 9LR. Again at Tampico, 1AR on straight C.W.

Another operator, off Isle de Pinos, Cuba, Dec. 23 nd 24, reports: 4BK, 5BI, 5HI, 5WN, 5XA, 5YH, 5ZN, 5ZS, 8FI, 8HR, 8IN, 8JF, 8KP, 8ZC, 8ZY, 8AKV, 8ANO, 9AP, 9EQ, 9HI, 9JN, 9JQ, 9KV phone, 9LM, 9LQ, 9MC, 9MH, 9VZ, 9WZ, 9ZN.

S.S. "Ellis", at Tela, Honduras, Dec. 24 to Jan. 22: BCO, 2JU, 2RK, 4AT, 5AJ, 5AO, 5CG, 5EA, 5EJ, 5EO, 5FL, 5HL, 5JE, 5XA, 5XB, 5XC, 5YE, 5YH, 5ZA, 5ZC, 5ZF, 5ZP, 5ZU, 5ZX, 8HH, 8JJ, 8ZL, 9AP, 8AAC, 9AEG, 9CA, 9EQ, 9JN, 9LR, 9OE, 9ZA, 9ZB, 9ZE, 9ZJ, 9ZL, 9ZN. Ne QSS. 9AEG regularly loudest.

KDEV in Tampico, Nov. 25: 5XB, 5ZG, 5ZZ, 9XM, 9LA. Jan. 12 in Galveston Bay: 5YE, 5EA, 5ZE, 5XB, 9YW, 9HN, 9XJ, 9YD, 9YY, 9YA. Jan. 11, 152 m. south of Galveston, 5XB phone QSA.

INAQ, HARTFORD, CONN.—December.

1AZ, 1BM, (1CK), 1CZ, 1DY, 1EA, 1EK, (1FQ), 1GM, 1GW, 1GY, 1JN, (1JQ), 1JZ, 1OE, 1QN, 1RZ, 1SZ, (1TS), 1UJ, 1WP, 1XE, 1XF, (1XT), 1XX, 1CAS, (1DAP), (1BBL), 1EAV, 1FAQ, 1GBC, 1GBT, 1HAA, 1JAP, 1HBP, 1KBT, 1MAW, 1UAV, 1UAW, 1VAO, 1RAY, 2BB, 2BG, 2CC, 2CO, 2CT, 2DA, 2DF, 2DH, 2DN, 2DS, 2EL, 2FC, 2FG, 2GO, 2GR, 2HG, (2HN), 2IW, 2JU, 2MP, 2OA, 2OB, 2OM, 2RK, 2RM, 2TF, 2UC, 2WP, 2XF, 2YM, 2ZD, 2ZL, 2ZM, 2ACM, 2ARW, 2CY, 3BG, 3BH, 3BK, 3BZ, 3CC, 3CS, 3DH, 3EN, 3GO, 3HB, 3HF, 3JH, 3IN, 3KU, 3PU, 3SH, 3VV, 3ZE, 3HK, 3XF, (3ABC), 4AG, 4AL, 4CU, 4EK, 4YB, 5AK, 5HL, 5DA, 5AM, 5BA, 5DC, 5DH, 5EP, 5DP, 5DR, 5DT, 5DV, 5ER, 5FB, 5FJ, 5FN, 5FT, 5GA, 5GL, 5GN, 5GO, 5GR, 5GT, 5GW, 5HA, 5HG, 5HM, 5HQ, 5HY, 5IC, 5ID, 5IN, 5JF, 5JJ, 5JU, 5KG, 5GZ, 5LF, 5LQ, 5ML, 5MU, 5MZ, 5NZ, 5QJ, 5QM, 5RI, 5RK, 5RW, 5SP, 5WX, 5WY, 5XE, 5XM, 5XU, 5XK, 5ZA, 5ZD, 5ZI, 5ZJ, 5ZL, 5ZR, 5ZT, 5ZV, 5ZW, 5ZY, 5ZZ, 5ABG, (5ACF), 5AFB, 5AKA, 5AMZ, 5ARW, 5AJW, 5AA, 5EE, 5ET, 5FN, 5AP, 5HZ, 5KV, 5LM, 5UU, 5ZJ, 5ZL, 5ZN, BCO, NSF, WWV, XF1.

ITS, BRISTOL, CONN.—December.

1AAG, (1AE C.W. & Spk.), 1AN, 1AS, 1AU, (1AW), 1AZ, 1BAB, 1BAY C.W., (1BB), 1BC, 1BL, 1BM, 1BP, 1BU, (1CK), (1CM), (1CZ), 1DAP, 1DBU C.W., 1DR, (1DY), (1EAS), (1EAV), (1EBW), 1EK, 1EN, 1EP, 1ES, 1EZ, (1FAQ), 1FBF, 1FB, 1FF C.W., 1FV, 1FW, (1GA), 1GAW, 1GAX, 1GBC, 1GBT, 1GJ, (1GM), (1GY), (1HAA), 1HAF, 1HAK, 1HAX, 1HBP fone, (1IA), (1IBD), 1JAP, 1JAR, (1JBF spk. C.W. & fone), 1JBG, 1JB, (1QJ), 1GAQ, (1KAZ spk. & C.W.), (1LA), 1LAY, 1IMAD, 1IMA, 1MB, 1MX, (1NAQ), (1NAT), 1NO C.W. & fone, 1OAD, (1OE), 1OJ, 1OW, 1PAO, (1PG), 1QN, 1QR C.W., 1QT, 1RAY, (1RU C.W. & fone), 1RV, (1RX), (1RZ), 1SH, (1SZ), (1TAZ), 1UAW, 1UD, (1UJ), 1UL, 1UQ, 1VA, (1VC fone), 1WAP, (1WJ), 1WP, (1WR), 1XD fone, 1XE spk. & fone, (1XT), (1XV C.W. & fone), (1XX C.W.), 2AAC, 2AB, 2ABM, 2ACC, 2ACD, 2ACM, 2ACW, 2ADP, 2AEF, 2AEG, 2AEI, 2AJW, 2AM, 2ANZ, 2AQL, 2AR, 2ARA, 2ARB, 2BAD, 2BB, 2BED, 2BEH, (2BG), 2BGR, 2BK, (2BM), 2BO, 2CC, 2CL, 2CS, 2DA, 2DI, 2DK, 2DN, 2DS, (2EL), 2FS C.W., 2GM, 2HN, 2HX, (2HZ C.W.), 2IN, (2JJ), 2JN, 2JU, 2JZ, 2KY C.W. & fone, 2LO, 2ME, 2MM, 2MP, (2NN),

(ZOM), 2OX, 2PF, 2PL, 2RB, (2RK), (2RM),
2RV, 2SZ, (2TF), 2TS, 2UE, 2UK, 2VA, 2ZL,
(2WD C.W.), 2XK, 2XJ fone, 2XJ 4 fone, 2XQ
spk., C.W. & fone, 2ZC, (2ZD), 2ZL C.W. & fone,
2ZM, 3AAC, 3AB, 3ABC, 3ACS, 3AIS, 3AHK,
3AXC, 3BF, 3BG, 3BH, 3BZ, 3CC, 3CL, 3DC,
3DH, 3DK, 3DR, 3DS, 3EN, 3EV, 3FG, (3FM),
3FN, 3FR, 3GL, 3GO, 3GX, 3IW, 3HG, (3HJ),
3HX, 3JC, 3KM, 3LP, 3OB, (3PU), 3QL, 3QV,
3QW, 3RW, 3SW, 3TJ, 3UC, 3UF, 3UX, 3V,
3ZA, 4XB C.W., 5AAV, 5AB, 5ACF, 5AFB, 5AFQ,
5AHH, 5AJB, 5AJW, 5AKA, 5AL, 5AMF, 5AMQ,
5AMZ, 5ANJ, 5APB, 5ARK, 5ARW, 5AY, 5BO,
5BP, 5BV, 5CF, 5CG, 5CV, 5DC, 5DI, 5DR, 5DT,
5DV, 5EC, 5EV, 5FI, 5FK, 5FT, (5FW), 5GI, 5GH,
5GW, 5HA, 5HF, 5HL, (5HP), 5HY, 5ID, 5IEF,
5IL, 5IN, 5IV, 5JF, 5JJ, (5JS), 5NL, 5NZ, 5PN,
5PQ, 5PU, 5QB, 5SQ, (5QM), 5SQ, 5RQ, 5SH,
5SP, 5TB, 5TT, 5UK, 5VJ, 5VQ, 5VS C.W., 5WO,
5WY, 5XE, 5XH, 5XI, 5XK C.W. & fone, 5XR
C.W., 8XU C.W., 8ZA, 8ZD, 8ZE, 8ZG spk. & C.W.,
8ZL, 8ZP, 8ZR, 8SZ, 8ZT, 8ZU, 8ZW, 8ZW spk.
& C.W., 8ZY, 8ZZ, 9AAC, 9AAV, 9AAW, 9AEG,
9AK, 9AP, 9CA, 9CW, 9EQ, 9GP, 9GS, 9HR, 9JN,
9JQ, 9JT, 9LM, 9LQ, 9MH, 9OE, 9OR, 9UH, 9XI
C.W., 9XM spk. & C.W. & fone, 9YB, 9ZJ, 9ZL,
9ZN spk. & C.W., 9ZQ.

IKAY, PORTLAND, ME.—Oct. 10 to Dec. 18
1AE (C.W.), 1AK, 1AW, 1AZ, 1BAB, 1BAC
1BBK (fone), 1BBL, 1BM, 1BS, (ICAO), 1CAY
1CBX, 1CK, 1CM, 1CZ, 1DQ, 1DU, 1DY, (1EAV)
(1EAX), (1EK), 1FBF, 1FBS, (1FM), (1FV)
1FZ, 1GBC, 1GBL, 1GBT, 1GM, 1GY, 1HAA
(1HAK), 1JAP, 1JB1, (1JB1), (1KB1), 1LAX
1NH, 1OA, (1OE), 1OT, 1PAC, (1PAO), (1PAW)
1PU, 1PY, 1RAY, 1RV, 1SL, (1TS), 1UWA
(1UL), (1UQ), (1VY), 1WAP, (1XT), 1XE
(phone), 1XX (C.W.), 1XD (phone), (1YD), 1ZD
2AB (phone), 2ADD, 2AEF, 2AER, 2AFZ, 2AHK,
2AJN, 2AK, 2AM, 2AR, 2BB, 2BF, 2BG, 2BH
2BK, 2BL, 2BM, 2BT, 2CS, 2CT, 2DA, 2DH, 2DN
2DR, 2EH, 2EL, 2GO, 2BR, 2HG, 2HX, 2JJ, 2JN
2JU, 2JZ, 2KE, 2KY (fone & C.W.), 2NV, 2OA
2OM, (2OO), 2RL, 2QR, 2RB, 2RK, 2RV, 2SH
2TF, 2TG, 2UC, 2UE, 2WB, 2WM, 2XI (C.W.),
2XX (C.W. & phone), 2ZC, 2ZD, 2ZL (C.W.)
3AAP, 3ABD, 3BE, 3BG, 3BH, 3BQ, 3BZ, 3CC
3CS, 3DH, 3EH, 3EL, 3EN, 3FB, 3FR, 3GO, 3HG
3HJ, 3KM, 3MO, 3ND, 3PU, 3VV, 3VW, 3ZA
3ZE, 3ZW, 4AL, 4EN, 4DM, 4KM, 5DA, 5XA
(C.W.), 5ZL, 8AB, 8AC, 8ACF, 8AEA, 8AG, 8AMQ,
8ANJ, 8AY, 8DF, 8AC, 8CJ, 8DC, 8DI, 8DK, 8DP
8DR, 8DV, 8DY, 8ER, 8FK, 8FT, 8FW, 8GI, 8GW,
8HG, 8HH, 8HP, 8ID, 8II, 8IK, 8JF, 8JJ, 8K
8KE, 8KM, 8KP, 8LB, 8MG, 8ML, 8MT, 8NL
8QJ, 8QM, 8SQX, 8R1, 8RT, 8RW, 8SH, 8SP, 8TB,
8TTQ, 8WY, 8XK (BM & fone), 8XU, 8ZA, 8ZD
8ZE, 8ZG, 8ZL, 8ZO, 8ZX, 8ZL, 8ZZ, 9AU, 9BW,
9FG 9FN, 9FV, 9GN, 9HR, 9JN, 9LC, 9LM, 9LQ,
9LZ, 9LQZ, 9UH, 9UM, 9UU, 9XM, 9ZJ, 9ZL
9ZN, Canadian 2CI (ex 3Z) NSF, (phone, C.W.
& BM), WWV.

IHAA, MARION, MASS.—December
 1AK, 1AW, 1BS, 1BBL, 1CK, 1CM, 1CY, 1EY, 1ES,
 1ICAY, 1ICBC, 1DT (C.W.), 1DY, 1IV, 1EK, 1ES,
 1FV, 1FBF, 1FBV, 1GY, 1GZ, 1GM, 1GBC, 1HO,
 1IBV, 1JAP, 1JR, 1JAR, 1JBV, 1JBT, 1IMD, 1OE,
 1OZ, 1QAV, 1RV, 1RZ, 1TS, 1UD, 1UL, 1UE, 1WR,
 1XD, 1XT, 1XX, 1ZK, 2AM, 2AR, 2ANZ, 2ARY,
 2ABM, 2AER, 2BK, 2BO, 2BM, 2BB, 2CP, 2DA,
 2DN, 2EL, 2HN, 2HZ, 2HX, 2JU, 2JZ, 2JN, 2KY
 (C.W.), 2TF, 2OA, 2RK, 2ZD, 2ZH, 2XX, 3ABD,
 3ACM, 3ACS, 3CC, 3DH, 3EN, 3GX, 3HJ, 3SH,
 3KN, 3OB, 3PU, 3QF, 3VV, 3NSF, (4CM), 4LL,
 4YB, 5AO, 5ZF, 5AL, 8AMZ, 8BC, 8DY, 8EC,
 8FK, 8GI, 8HP, 8ID, 8JS, 8JJ, 8YH, 8KP, 8KZ,
 8LM, 8ML, 8MZ, 8NI, 8SP, 8TT, 8RZ, 8WY, 8VJ,
 8ZD, 9OX, 9ZN.

2XQ, SCHENECTADY, NEW YORK
Nov. 15 to Jan. 1st.
(1ARY), (1AW), 1CJ, (1CK), 1CM, 1CZ, 1EAV,
(1EBW), 1EP, 1GM, 1GY, (1HAA), (1JAP),
(1JQ), (1OE), 1OO, 1OW, (1RAY), 1SHZ, (1TS),
(1XX), 1YA, 2ACM, (2AIF), 2ALK, 2AM, 2ANJ,
2ANM, (2AWE), (2AZP), (2BB), (2BK), (2RM).

2BO, 2CC, 2CT, 2DA, (2DN), 2GR, 2HX, (2JJ),
 2JU, (2JZ), 2OA, 2OU, 2PV, 2RK, 2RV, (2SZ),
 (2TF), (2XA) fone, 2ZD, 2ZL, 2ZM, 3AFF, 3ABC,
 3ABD, 3ACM, 3AH, (3AHK), 3AK, 3APP, 3AR,
 (3BG), 3BZ, 3CC, 3CS, (3DH), 3DV, 3HE, 3ER,
 3FB, 3FJ, 3FR, 3GO, 3GV, 3HJ, 3HX, 3IX, 3MC,
 3OB, (3OU), 3UC, 3UV, 3XF, 3ZA, (3ZS), 4TB,
 4CP, 4DM, 8AB, 8ACF, 8ACH, 8AGW, 8AHF,
 8AHK, (8ANJ), 8ARW, 8BP, 8BV, 8CG, 8CZ,
 (8DR), 8DV, (8FD), 8FK, 8FV, (8HA), 8HG,
 (8HP), (8HR), 8GE, 8GL, 8ID, 8IK, 8IN, (8JF),
 8JJ, (8JS), 8JU, 8JX, 8KE, 8KM, 8KP, 8LB,
 8LF, 8LG, 8LQ, 8LZ, 8NL, 8NZ, (8OI), 8PN, 8RQ,
 8RY, 8SP, 8SW, (8TB), 8TD, 8TN, 8UL, 8WO,
 8WY, 8XE, 8XH, 8XK (ICW & fone), 8XM, (8XU),
 8ZB, 8ZD, 8ZE, 8ZG, (8ZL), 8ZR, 8ZV, 8ZW,
 (8ZX), (8ZY), (8ZZ), 9AU, 9AAC, (9AAV),
 9AAW, 9ABL, 9AJI, 9AW, 9EE, (9FG), 9HR,
 9JN, 9JQ, 9LQ, 9LM, 9MH, 9XM, 9YM, 9ZJ,
 (9ZL), (9ZM), (9ZN), NSF.

HEARD AT 2EX, RUTHERFORD, N. J.

Nov. 15th to Jan. 23

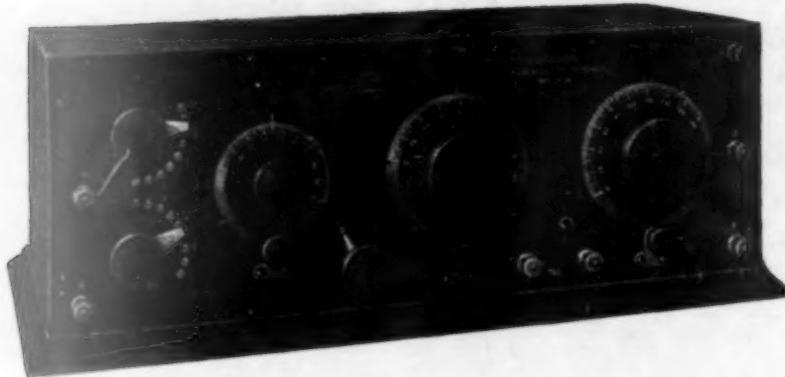
1CK, 1DR, 1DY, 1JQ, 1OE, 1XT, 1BAB, 1BBL,
 1HAA, 1HAHF, 1HBZ (C.W.), 1OAL (C.W.), 1LX
 (C.W.), 3AB, 3CK, 3DH, 3GO, 3PW, 3VV, 3QW,
 3XF, 3XG, 3YV, 3ZE, 3ACS, 3AHK, 4BZ, 4CP,
 4XB (C.W.), 5DA, 8DE, 8FD, 8GT, 8HA, 8IK,
 8IV, 8JF, 8JP, 8LM, 8LQ, 8QG (C.W.), 8SH, 8SP,
 8U, 8WY, 8XE, 8XK, 8XS, 8XU, 8YG (C.W.),
 8ZG, 8ZR (Spk. and C.W.), 8ZW, 8ZV, 8ZY,
 8ABG, 8ALE, 8ARW, 9ZJ, 9ZL, 9ZN, 9AWX.
 Phone stations: 10AU, 2DF, 2FZ, 2GF, 2IA, 2IC,
 2KY, 2MC, 2QR, 2RU, 2SS, 2TT, 2VK, 2WD, 2WN,
 2XC, 2XF, 2XJ, 2XK, 2ZD, 2ZL, 2ZM, 2ABA,
 2ABR, 2ABZ, 2ACI, 2ACF, 2AJF, 2ALR, 2ALZ,
 2ANX, 2AQF, 2ARA, 2AVR, 2AWL, 2AWM, 2AXB,
 2AYZ, 2BEA, 2BGA, 2BGM, 2BHK, 2BHN, 2XK,
 2ZW, 2NSP.

3AAS, HAGERSTOWN, MD.—December.
1AW, 1BAB, 1BB, 1BBL, 1CK, 1CM, 1CZ, 1GBC,
1GBT, 1HAA, 1OE, 1TS, 1WJ, 1WR, 2AER, 2AF,
2ALK, 2BB, 2BM, 2CS, 2CY, 2DA, 2DI, 2DN,
(2EL), 2HG, 2HN, 2JJ, 2JO, 2JU, 2JZ, 2OO,
2RB, 2RK, 2RM, 2TF, 2UE, 2VA, 2WE, 2ZH,
3ABD, 3ACS, 3BF, (3BH), (3BL), 3BZ, 3EH,
3EN, 3EV, (3GO), 3HG, 3HJ, 3HX, 3LS, 3PB,
(3PU), 3RB, 3SF, 3UG, 3VA, (3VY), 3XF, 3YY,
4AG, 4AL, 4AO, 4DM, 4EY, (4YB), 5DA, 5AAU,
5AAV, 5AAW, 5ADE, 5AEE, 5AFB, 5AGB, 5AGM,
5AGO, 5AHR, 5AKV, 5AMQ, 5AMZ, 5ANO, 5AY,
5BV, 5CF, 5DG, 5DJ, 5DV, (5DR), 5DZ, 5EC,
5EZ, 8FG, (8FK), 8FP, 8FT, 8FW, 8GB, 8GC,
8GG, 8GT, 8GW, 8HA, 8HJ, 8HP, 8HY, 8ID, 8IK,
8JJ, 8JS, 8KE, 8KK, 8KP, 8LF, 8MC, 8MM,
8MP, 8MZ, 8NG, 8NI, 8NZ, 8OJ, 8OZ, 8SQJ, 8QS,
8RQ, 8RS, 8SP, 8TT, 8UK, (8VJ), 8WY, 8XH,
8XU, 8ZA, 8ZE, 8ZL, 8ZR, 8ZV, 8ZZ, 9AAV, 9ABL,
9ACD, 9ADV, 9AEQ, 9AJN, 9AOAT, 9AP, 9AWX,
9CS, 9EL, 9EQ, 9ET, 9GC, 9GN, 9GS, 9HY, 9JL,
9KV, 9LF, 9LQ, 9MC, 9MS, 9NQ, 9UH, 9UU, 9ZB,
9ZN, 9ZO, 9ZZ.

3ZA, BALA, PENNA.—December.
 1AW, 1BBL, 1CK, 1CZ, 1DR, 1DY, 1EB, 1FBW,
 1GM, 1HAF, 1IQ, 1JAP, 1OW, 1PG, 1PZ, 1RAY,
 1TS, 1WZ, 1WAP, 1XT, 2AIM, 2BB, 2EL, 2HN,
 2JJ, 2JU, 2OA, 2OU, (2RK), 2TE, (2TF), 2UE,
 2XQ, 2ZM, 3AB, 3ABC, 3AES, (3EN), 3GO, 3GX,
 3HG, 3KM, 3PU, (3QW), 3UU, (3VV), 4AG, 4AL,
 4AL, 5ET, 5AL, 5AF, 8AY, (8AJW), 8AKA,
 8AMB, 8ANJ, 8BP, 8CV, 8DV, 8ED, 8FK, 8GL,
 8GW, 8HP, 8IL, 8KE, 8LA, 8LF, 8NI, 8OJ, 8QM,
 8RQ, 8RW, 8SP, 8TT, 8VJ, 8WY, 8XH, 8ZD, 8ZE,
 8ZL, 8ZW, 8ZZ, NSF.

3BZ, DANVILLE, VA.—December.
1(AW), 1AHF, (1BBL), (1CL), 1DY, 1GB, 1IR,
1OE, 1XE, (1RZ), 1HAA, 1RAY, 2AER, (2BB),
2BK, 2BQ, 2DA, 2DR, 2EL, 2GU, 2JU, 2JJ,
2RB, 2RK, 2RZ, 2SZ, 2ZC, 2ZM, 2ZL, 3AAS,
3ABC, 3ABD, 3AHK, 3BB, 3BG, 3DS, (3EN),
3EV, 3EY, (3EH), (3FG), (3GO), 3GX, 3JJ,
(3KM), 3OB, 3OF, (3PU), 3RZ, (3VV), (3XF),
3ZE, (NSF), (4AG), 4AN, (4BK), (4BL), (4BQ),
(5BY), (4DM), 5XB, 4XC, 4YB, (5DA), 5JD,
(5KD), 5XA, 5YB, 5YH, 5ER, 5PC, 5ZS, 8ACF

PRINT IN BINDING



Licensed under Armstrong and Marconi patents

If it ISN'T an R. A. TEN, it ISN'T a

*This advertisement is published more
for your protection than ours.*

OF COURSE, we have known all along that imitators were using the PARAGON name, but only recently did we realize how radio men were being deceived. Letters have come in, however, from a number of amateurs who bought these fake PARAGONS, and were tremendously disappointed.

Probably there are hundreds more who do not realize the real situation.

The genuine PARAGON R.A. TEN (use full name), is manufactured only by Adams - Morgan Co.; and is sold exclusively by Continental and affiliated dealers. The complete name is copyrighted, and the

use of the PARAGON name on other instruments is therefore not only unfair and deceptive, but also illegal. (Two previous models of Adams-Morgan Co.; the PARAGON R.A. 6, and the PARAGON R.A. 200 Universal Range receiver, are of course genuine. However these models are now discontinued and the PARAGON R.A. TEN is the only genuine PARAGON on the market.)

Be sure to get a PARAGON.—a real PARAGON,—the only receiver with a wave length range up to 1000 meters, combined with no decrease in amplification.

Send in your remittance now, and your PARAGON will be shipped at once.

Or, let us send you our FREE bulletin, describing, in detail; the features of the PARAGON R.A. TEN.

CONTINENTAL RADIO AND ELECTRIC CO.

J. DI BLASI, Secretary

DEPT. B-21,

Sole Distributors of the Paragon RA-Ten

6 WARREN STREET,

Be sure it's a *real*
PARAGON.—Lock
for the phrase,
TYPE R. A. TEN,
engraved in the
Bakelite panel.

T a PARAGON

Outstanding features of the Genuine PARAGON R.A. TEN

(Reg. U. S. Pat. Off.)

Amplifying Short Wave Receiver

Wave length, 160 to 1000 meters.

Amplification 100 times.

No dead end losses whatever.

Vernier attachments on all controls.

Coupling has scale of 180.

Free from all body capacity effects.

Guaranteed for two years.

The weaker the signal, the stronger the amplification".

Price, Eighty-Five Dollars.

C CORPORATION

J. STANTLEY, Treasurer

NEW YORK

WHEN WRITING TO ADVERTISERS

You can enjoy Continental Service,—by Mail—

THE SAME courtesy,—the same helpful attention that has pleased our customers here in the store, extends to our mail order department. We ship exactly what you order, the day you order it,—and it's packed to arrive in perfect condition.

Our new 112 page catalogue, now out, contains probably the widest assortment of radio goods ever assembled together. The appendix contains tables for easily figuring all radio calculations, also conventional signals and abbreviations, etc. This valuable catalogue mailed anywhere in the world for 25c. Send for your copy today.

Partial list of our mail order specialties follows. Order direct from this ad, and then send for complete catalogue.

VACUUM TUBES

Radiotron Detector	
Tubes	\$5.00
Electron Relay	
Detector Tubes	.60
Electron Relay	
Amplifier Tubes	.75

OMNIGRAPHES

No. 313 Ominigraph	
Complete	\$20.00
No. 2 Jr. Complete	28.00
Extra Dials, each	.20
No. 342 Practice Set	
with battery	4.00

BUZZERS

No. 55 Meso	\$2.50
No. 251 Meso	.95
No. 168 Century	2.50

AMRAD GAPS

No. G-1 1 K.W.	
Gap	\$41.50
No. G-2 $\frac{1}{2}$ K.W.	
Gap	24.50
No. G-3 $\frac{1}{4}$ K.W.	
Gap	16.00

BENWOOD GAPS

No. 1 Benwood Gap	
complete	\$30.00
No. 8 8 Stud Rotor	8.00
No. 10 10 Stud	
Rotor	8.00
No. 14 14 Stud	
Rotor	8.00

GRID LEAKS

Marconi Complete	
with holder and leak	\$1.00
No. RORA Grebe	
Condenser and leak	1.60
G-100 DeForest	
Variable leak	.75

LINE PROTECTORS

No. 379 Murdock	
Line Protector	\$9.00
No. AM888 Dubilier	
Line Protector	4.00
No. CD888 Dubilier	
Line Protector	6.00

TUNGAR RECTIFIERS

Two Ampere Tungar	
complete	\$18.00
Five Ampere Tungar	
complete	28.00
Two Ampere Extra Lamp	
Lamp	4.00
Five Ampere Extra Lamp	
Lamp	8.00

BURGESS "B" BATTERIES	
22 $\frac{1}{2}$ Volts Large	
"B" Battery	\$3.50
22 $\frac{1}{2}$ Volts Small	
"B" Battery	2.50

PARAGON CONTROL PANEL

No. 5 Paragon Control panel	\$6.00
-----------------------------	--------

Our word of honor to you is
our guarantee—Let us prove it.

MARK AND MAIL THIS COUPON TODAY

Continental Radio and Electric Corp., Dept. B-21,
6 Warren Street, New York City.
Gentlemen:



Enclosed find remittance for \$85.00. Ship at once one of your wonderful, new PARAGON R. A. TEN receivers. Send me, FREE, your complete and interesting booklet, describing every phase of the PARAGON R. A. TEN'S superiority.

Enclosed find remittance for 25c. Send me your 112 page complete radio catalogue.

Name _____

Address _____

Our Chicago Store



MONTGOMERY

High Grade

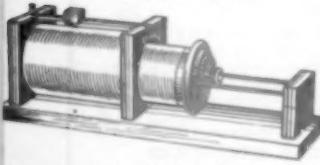
Order Direct From These Pages.

Navy Type Receiving Transformer



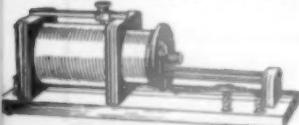
63S800—A very selective instrument for the more advanced stations. Primary inductance is controlled in steps by units and tens switches. Secondary has 12-point control. Has wave range up to 4,000 meters. Formica panels. Metal parts of brass. Single silk covered windings. Mahogany finished wood work. Base is 18 inches long, 6 1/2 inches wide. Ship. wt. 25 lbs. Price.....\$17.95

Arlington Type Receiving Transformer



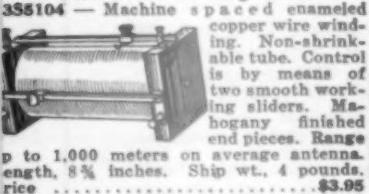
63S801—An efficient high-grade, long wave tuner. Has same winding as our Navy type. Will receive all government time stations such as Arlington and Key West. Works up to 4,000 meters. Primary controlled by slider. Secondary inductance varied by a 12-point switch mounted on Formica. Silk covered wire windings. Brass metal parts polished and lacquered. Mahogany finished wood work. Base, 18 inches long; 6 inches wide. Shipping weight, 14 pounds. Price.....\$7.70

Junior Loose Coupler



63S5103—A fine instrument for 200 to 600 meter work. Primary controlled with slider, secondary by 5 point switch. Metal parts brass, polished and lacquered. Wood-work mahogany finish. Base, 12 x 3 1/2 inches. Ship. wt. 6 pounds. Price.....\$5.70

Two Slide Tuning Coil



63S5104—Machine spaced enameled copper wire winding. Non-shrinkable tube. Control is by means of two smooth working sliders. Mahogany finished end pieces. Range up to 1,000 meters on average antenna. Length, 8 1/2 inches. Ship. wt. 4 pounds. Price.....\$3.95

Loading Coil

63S5105—Essentially the same as two slider tuning coil, but has only one slider. Will add about 300 M range to any set. Ship. wt. 3 lbs. Price.....\$3.40

SATISFACTION GUARANTEED OR YOUR MONEY BACK

Radio amateurs will no doubt welcome the opportunity that they now have to obtain high grade radio apparatus from this large mail order house. Montgomery, Ward & Company has a record of 50 years of fair dealing with their customers who now number over 5,000,000. This institution was the first to adopt the guarantee of Satisfaction or Your Money Back. This guarantee applies to all radio goods shown on this and the five following pages. Order any of the apparatus on these pages and give it a 5 day trial. If at the end of 5 days it is not what you expected it to be, return it to us in the same condition in which you received it and we will promptly return your money together with the transportation charges you have paid.

Universal Detector

63S5304—A detector of correct construction. Permanent adjustment. Galena, silicon and other minerals can be used. Molded base and adjustment knob. Metal parts of brass, polished finish. Tested piece of silicon included. Base size, 2 1/2 x 3 1/2 in. Ship. wt. 1 lb. Price.....\$1.88



Standard Galena Detector

63S5305—A popular detector. Tested piece of galena is mounted in cup which can be rotated. Crystal contact of phosphor bronze wire coiled and pointed and set on flat spring. Very fine adjustment obtainable with screw. Molded base and adjustment knob. Base, size, 3 x 3 inches. Ship. wt. 1 1/2 lbs. Price.....\$1.43

Murdock Detector Stand

63S5302—A good low priced detector stand. Will do very satisfactory work. Molded black composition base. Adjustable cup and contact. Nickel plated binding posts. No crystals included. Size, 2 1/2 x 1 1/2 x 2 in. Ship. wt. 4 oz. Price.....70c



Detector Crystals
Genuine Arlington Tested Minerals. Absolutely the best crystals that can be purchased for any price. All are thoroughly tested and guaranteed. Extremely sensitive. Packed separately in sealed boxes. Ship. wt. about 3 oz. **63S5320**—Supersensitive Galena. Per crystal.....29c

63S5322—Supersensitive Silicon. Per crystal.....29c
63S5324—“Radiocite”. Per crystal.....25c

Radiotron V.T. Detector

63S5194—This is a “soft” tube especially suited for detector use and is also an excellent audio frequency amplifier. It produces excellent results in regenerative circuits. Has the familiar hissing point and low B battery potential requirements. Standard four-prong mounting. Ship. wt. 1 lb. Price.....\$5.00
63S5620—4000 ohm potentiometer graphite. Often used with soft vacuum tubes. Semi-circular, 2 1/2 in. diam., 1/8 in. wide, 1/4 in. thick copper plated ends. Price \$1.50



Radiotron Amplifier Oscillator

63S5192—A high vacuum amplifier and detector. Requires no critical adjustment. Designed for amplification and undamped wave reception by the regenerative method. May be used singly for receiving continuous waves or in cascade as a two or more step amplifier. Ship. wt. 1 lb. Price.....\$6.50

Socket for Vacuum Tube

63S5342—Socket is mounted on bakelite sheet. Four binding posts for connections. Screw holes for flat mounting, screws in side of base for panel mounting, permitting either upright or vertical position of tube. Ship. wt. 8 oz. Price.....\$1.40



Improved V.T. Socket

63S5343—Improved long flat spring contacts insure positive contact on any standard tube base prongs. Glossy black composition base. Nickelized tube. Marked screw connections. May be used and wired in any position. Ship. wt. 8 oz. Price.....\$1.00

Order direct from these pages. See instructions on second page following this one.

Montgomery Ward & Co.

Satisfaction Guaranteed or Your Money Back

CHICAGO, ILL.

KANSAS CITY, MO.

Send Your Order to House Nearest You.

PY AVAILABLE

WARD & CO.

Radio Supplies

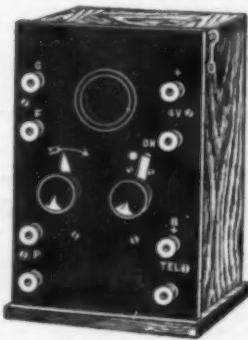
See Instructions for Ordering on Next Page.

Our Kansas City Store



Vacuum Tube Control Detector Cabinet

An efficiently arranged fine looking detector cabinet. The best value and the highest grade instrument we have found. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Grid condenser. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered red oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size, $7\frac{1}{2} \times 5\frac{1}{4}$ in. Ship. wt., 6 lbs. No tube included. \$355170—Detector cabinet



Vacuum Tube Control Panel

63S5105—A compact, handy V.T. panel. Standard socket, rheostat, grid condenser, grid leak and binding posts all mounted on moulded bakelite panel. Metal polished nickel finish. A high grade, expensive instrument that will do as good work as the highest price cabinet. Bar size, $3\frac{1}{2} \times 5$ in. Ship. wt., $2\frac{1}{4}$ lbs. Price



V.T. Amplifier Cabinet

Arranged to work in conjunction with any V.T. detector cabinet. Being of the same size and construction as our special detector cabinet the two make a desirable combination. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Improved amplification transformer. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size, $7\frac{1}{2} \times 5\frac{1}{4}$ in. Ship. wt., 7 lbs. No tube included. \$355172—Amplifier Cabinet

\$17.95

Murdock Variable Condenser

Enclosed Type

63S5175—Murdock No. 367. Polished black composition top and bottom with transparent enclosing cylinder. 22 stationary plates, 21 movable plates Cap., .001 M.F. Diam. $3\frac{3}{4}$ in. Height, $3\frac{1}{4}$ in. Binding posts and arrow pointer are nickel plated. 180 degree engraved scale. Ship. wt., $2\frac{1}{4}$ lbs. Price \$4.00. 63S5177—Murdock 368. Same as above but has 12 stationary plates and movable. Capacity, .0005 M.F. Ship. wt., $1\frac{1}{2}$ lbs. Price \$4.00.



DeForest Variable Condenser for Panel Mounting

63S5173—The best value in high grade variable condensers. Rugged, durable construction. 13 aluminum stationary plates, 12 rotary plates. Overall dimensions $4\frac{1}{2}$ in. high, $3\frac{1}{4}$ in. wide, $3\frac{1}{2}$ in. long. Bakelite knob. Etched scale. Cap., .0005 M.F. Ship. wt., 1 lb. Price \$6.00.



Murdock Panel Type Variable Condenser

63S5178—Twenty-three plate .0005 M.F. capacity. Ruggedly assembled for panel mounting. Complete with mounting screws, knob, pointer, engraved 180 degree scale and anti-capacity handle. $\frac{1}{4}$ -in. shaft. Any standard knob or dial may be used. Requires space $3\frac{1}{4}$ in. wide; 2 in. deep for mounting. Ship. wt., $1\frac{1}{2}$ lbs. Murdock number 3681. Price \$3.00. 63S5181—Forty-three plates. Capacitance .001 M.F. Complete as above. Requires space $3\frac{1}{4}$ in. wide, $2\frac{1}{2}$ in. deep mounting. Ship. wt., $2\frac{1}{2}$ lbs. Murdock number 3661. Price \$4.00.



Knocked Down Variable Condenser

Furnished complete but unassembled, intended for either panel or table mount and are complete with scale pointer, knob, Formica tops and bases. Ship. wt., $1\frac{1}{4}$ lbs.

63S5163—Capacity, .001 M.F. 41 plates. Price \$2.00.

63S5185—Capacity, .0005 M.F. 21 plates. Price \$1.50.

63S5186—Capacity, .0005 M.F. 14 plates. Price \$1.25.

63S5187—Capacity, .0005 M.F. 11 plates. Price \$1.00.

63S5188—Capacity, .0005 M.F. 8 plates. Price \$0.75.

63S5189—Capacity, .0005 M.F. 6 plates. Price \$0.60.

63S5190—Capacity, .0005 M.F. 4 plates. Price \$0.40.

63S5191—Capacity, .0005 M.F. 2 plates. Price \$0.25.

63S5192—Capacity, .0005 M.F. 1 plate. Price \$0.15.

63S5193—Capacity, .0005 M.F. 1 plate. Price \$0.10.

63S5194—Capacity, .0005 M.F. 1 plate. Price \$0.05.

63S5195—Capacity, .0005 M.F. 1 plate. Price \$0.02.

63S5196—Capacity, .0005 M.F. 1 plate. Price \$0.01.

63S5197—Capacity, .0005 M.F. 1 plate. Price \$0.005.

63S5198—Capacity, .0005 M.F. 1 plate. Price \$0.002.

63S5199—Capacity, .0005 M.F. 1 plate. Price \$0.001.

63S5200—Capacity, .0005 M.F. 1 plate. Price \$0.0005.

63S5201—Capacity, .0005 M.F. 1 plate. Price \$0.0002.

63S5202—Capacity, .0005 M.F. 1 plate. Price \$0.0001.

63S5203—Capacity, .0005 M.F. 1 plate. Price \$0.00005.

63S5204—Capacity, .0005 M.F. 1 plate. Price \$0.00002.

63S5205—Capacity, .0005 M.F. 1 plate. Price \$0.00001.

63S5206—Capacity, .0005 M.F. 1 plate. Price \$0.000005.

63S5207—Capacity, .0005 M.F. 1 plate. Price \$0.000002.

63S5208—Capacity, .0005 M.F. 1 plate. Price \$0.000001.

63S5209—Capacity, .0005 M.F. 1 plate. Price \$0.0000005.

63S5210—Capacity, .0005 M.F. 1 plate. Price \$0.0000002.

63S5211—Capacity, .0005 M.F. 1 plate. Price \$0.0000001.

63S5212—Capacity, .0005 M.F. 1 plate. Price \$0.00000005.

63S5213—Capacity, .0005 M.F. 1 plate. Price \$0.00000002.

63S5214—Capacity, .0005 M.F. 1 plate. Price \$0.00000001.

63S5215—Capacity, .0005 M.F. 1 plate. Price \$0.000000005.

63S5216—Capacity, .0005 M.F. 1 plate. Price \$0.000000002.

63S5217—Capacity, .0005 M.F. 1 plate. Price \$0.000000001.

63S5218—Capacity, .0005 M.F. 1 plate. Price \$0.0000000005.

63S5219—Capacity, .0005 M.F. 1 plate. Price \$0.0000000002.

63S5220—Capacity, .0005 M.F. 1 plate. Price \$0.0000000001.

63S5221—Capacity, .0005 M.F. 1 plate. Price \$0.00000000005.

63S5222—Capacity, .0005 M.F. 1 plate. Price \$0.00000000002.

63S5223—Capacity, .0005 M.F. 1 plate. Price \$0.00000000001.

63S5224—Capacity, .0005 M.F. 1 plate. Price \$0.000000000005.

63S5225—Capacity, .0005 M.F. 1 plate. Price \$0.000000000002.

63S5226—Capacity, .0005 M.F. 1 plate. Price \$0.000000000001.

63S5227—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000005.

63S5228—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000002.

63S5229—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000001.

63S5230—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000005.

63S5231—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000002.

63S5232—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000001.

63S5233—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000005.

63S5234—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000002.

63S5235—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000001.

63S5236—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000005.

63S5237—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000002.

63S5238—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000001.

63S5239—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000005.

63S5240—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000002.

63S5241—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000001.

63S5242—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000005.

63S5243—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000002.

63S5244—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000001.

63S5245—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000005.

63S5246—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000002.

63S5247—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000001.

63S5248—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000005.

63S5249—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000002.

63S5250—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000001.

63S5251—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000005.

63S5252—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000002.

63S5253—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000001.

63S5254—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000005.

63S5255—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000002.

63S5256—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000001.

63S5257—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000005.

63S5258—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000002.

63S5259—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000001.

63S5260—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000005.

63S5261—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000002.

63S5262—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000001.

63S5263—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000005.

63S5264—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000002.

63S5265—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000001.

63S5266—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000005.

63S5267—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000002.

63S5268—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000001.

63S5269—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000005.

63S5270—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000002.

63S5271—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000001.

63S5272—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000005.

63S5273—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000002.

63S5274—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000001.

63S5275—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000005.

63S5276—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000002.

63S5277—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000001.

63S5278—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000005.

63S5279—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000002.

63S5280—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000001.

63S5281—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000005.

63S5282—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000002.

63S5283—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000001.

63S5284—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000005.

63S5285—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000002.

63S5286—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000001.

63S5287—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000005.

63S5288—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000002.

63S5289—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000001.

63S5290—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000005.

63S5291—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000002.

63S5292—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000001.

63S5293—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000005.

63S5294—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000002.

63S5295—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000001.

63S5296—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000000005.

63S5297—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000000002.

63S5298—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000000001.

63S5299—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000000005.

63S5300—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000000002.

63S5301—Capacity, .0005 M.F. 1 plate. Price \$0.0000000000000000000000000000000000001.

63S5302—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000000005.

63S5303—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000000002.

63S5304—Capacity, .0005 M.F. 1 plate. Price \$0.00000000000000000000000000000000000001.

63S5305—Capacity, .0005 M.F. 1 plate. Price \$0.000000000000000000000000000000000000005.

63S

Our Chicago Store



MONTGOMERY

Guarantees Satisfaction

Murdock No. 55 Head Set

These sets have given excellent service to thousands of users. Thin extra responsive diaphragms, fine quality permanent steel magnets, enameled copper wire windings. Nickel silver adjustable headband, complete with 5-foot cord. Ship. wt., 1½ lbs.

63S5370—Double set, 2000 ohms (total). Price... \$4.50

63S5371—Double set, 3000 ohms (total). Price... \$5.50

Brandes High Grade Receivers

The Brandes line of receivers is the very best. They are used throughout the world and are famous for their excellent workmanship, durability and extreme sensitivity. All have new Brandes speaker head bands, which is comfortable, easily adjusted, very light and will not catch the hair. Fitted with 6-ft. polarity indicating cord. The phones of each set are carefully matched tones. Ship. wt., lbs. per set.

63S380—Superior type, total res. 2000 ms. Complete. Wt., 14 oz. Price... \$8.00

63S381—Transatlantic type, total res. 3000 ohms. Complete. Wt., 11 oz. Price... \$12.00

63S382—Navy type, total res. 5000 ms. Very sensitive. Complete. Wt., oz. Price... \$14.00

Receiver Cord

63S385—Double receiver green mercerized cord, 6 feet long, for use with any standard receiver. Price..... .05c

Learner's Head Set
63S5383—Scientifically constructed for radio use. Should not be confused with ordinary telephone receivers sometimes furnished. These sets are just the thing those who wish a low priced sensitive head set. Res. 1000 ohms. Ship. about 1½ lbs. Price..... \$2.50

Watch Case Receiver

63S34—Regulation watch case telephone receiver. Moulded position case. Bipolar. Resistance, 80 ohms. Ship. wt., 12 oz. Price, each..... \$1.05

Fixed Receiving Condenser

A necessity on every receiving set. Used as "stopping" condenser or for shunting across telephones, alded composition bases. Nickel plated binding posts. Ship. wt., about 8 oz. Capacity, .01 M.F. Price... .90c

63S612—Capacity, .005 M.F. Price... 70c

INSTRUCTIONS FOR ORDERING

The prices shown on these six pages of Montgomery Ward & Co. Radio Apparatus are guaranteed against any advance until July 1st 1921. Keep this issue of QST and order direct from these pages as you need any additional equipment. Write your order on any plain piece of paper, giving article number, and enclose money order or bank draft. Register letter when sending currency. Add parcel post charges to your remittance. Figure up total weight of apparatus ordered and ask your postmaster what postage will be required. Send your order to our Chicago or Kansas City Store, whichever is nearest you. We guarantee safe delivery.

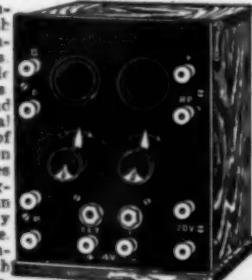
Unmounted Honeycomb Inductance Coils

High-grade inductance coils at attractive prices. Claimed by many users to be the best on the market. Made firm by varnish impregnation. Ship. wt., 4 to 16 oz. Wave length is in meters with .001 M.F. condenser. Not mounted.

Article Number	Turns	Approx. wave length range	Price
63S5470	25	130- 250	\$0.50
63S5471	35	180- 450	.50
63S5472	50	250- 700	.60
63S5473	75	400- 900	.60
63S5474	100	500- 1000	.65
63S5475	150	600- 1200	.70
63S5476	200	1000- 2500	.75
63S5477	300	1500- 4500	.85
63S5478	400	2000- 6000	.90
63S5479	600	4000-10000	1.15
63S5480	1000	8000-15000	1.60
63S5481	1250	10000-20000	2.00
63S5482	1500	16000-25000	2.50

Combined Detector and Amplifier

This instrument in connection with a set of inductance coils two variable condensers, batteries and a good aerial will permit the reception of all classes of radio signals over an extremely broad range. Used in conjunction with our Regenerator active set you have a receiving outfit that can only be excelled by adding additional stages of amplification. Detector and amplification tubes mounted inside of cabinet and are provided with rheostat control. Detector provided with grid condenser. High efficiency amplification transformer between detector and amplifier circuit. Jacks are wired in detector and amplifier circuit and a plug supplied for phones permitting use of detector or amplifier as desired. Dull finish bakelite panel 7½ in. high, 6½ in. wide. High grade weathered oak finish cabinet with hinged top, making interior easily accessible. Binding post connections for batteries and couplers. No tubes, batteries or phones included. Brass metal parts. Binding posts oxidized finish. Ship. wt., 12 lbs. 63S612—Price..... \$28.00

**Century Buzzer**

63S5346—Used by the Army and Navy and commercial wireless stations. For adjusting crystal detector. Operates on one or two dry cells. Base is hard rubber with black enameled brass cover. Two thumb screws provide for adjustment of the armature to regulate the tone to desired pitch. Genuine Platinum Contacts. Diameter of base, 2 in. Ship. wt., 6oz. Price... \$1.65

Test Buzzers

63S5345—Watch case buzzer. Nickel plated cover and base. Operates on one dry cell. 1 inch high, 1½ inches diameter. Ship. wt., 8 ounces. Price..... .65c

Test Buzzer Push Button

63S5137—For use with test buzzer. Nickel rim with pearl center. Held firmly in ¼ inch hole by small spring clips. Ship. wt., 4 oz. Price..... 19c

Grid Leak

63S5341—Pencil mark type, variable high resistance. When shunted across, stopping condenser keeps potential of grid of such value, that paralyzation is prevented, and most efficient results are obtained. Ready to mount on panel. Ship. wt., 3 oz. Price..... 75c

Wireless Transformers**Thordarson Type R**

For use on 108 to 115-volt alternating current, 60 cycles. Generally accepted as the standard transformer for amateur transmitting. Provided with adjustable magnetic leakage gap which controls primary input giving a wide range of amperage and permitting easy adjustment to point of resonance. No impedance or choke coil necessary in primary circuit. Ship. wt., 35 and 55 lbs.

Art. No. K.V.A. Amps. Sec. Volt Price
63S630 ½ 1 to 6 10,000 \$22.00
63S632 1 2½ to 14 25,000 40.00

Thordarson Type R.S. Transformer
This type differs from the model shown above only in that it does not have the adjustable magnetic shunt. All other features are the same. For use on 105 to 120 volt 60 cycle alternating current. Art. No. K.V.A. Sec. Volt Ship. wt. Price
63S633 ½ 8,000 15 lbs. \$15.00
63S634 ½ 10,000 25 lbs. 20.00
63S635 1 15,000 35 lbs. 30.00

CHICAGO, ILL. KANSAS CITY, MO.
Send Your Order to House Nearest You.

Montgomery Ward & Co.
Satisfaction Guaranteed or Your Money Back

SHIP AVAILABLE

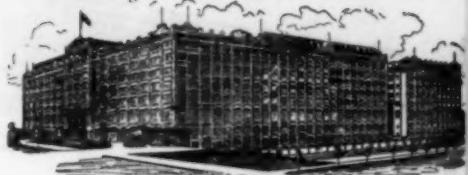
WARD & CO.

Or Your Money Back

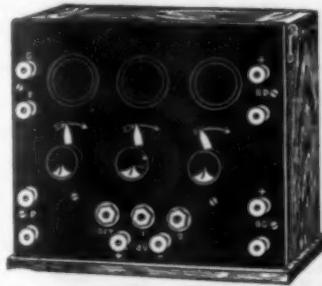
Order Direct From These Pages

See Instructions On Opposite Page

Our Kansas City Store



Combined Detector and Two Stage Amplifier



accessible. Binding post connections for batteries and couplers. Binding posts black oxidized finish. No tubes, batteries or phones included. Ship. wt., 18 lbs. \$34.95



Variable Condenser
63S620 — An oil immersed variable transmitting condenser for use with all makes of transformers up to 1 K.W., 25000 volts. Phenol fibre dielectric, corrugated aluminum separators allow circulation of oil to keep down heating. Flat aluminum sheet electrodes with rounded corners. Variable in ten steps of .0009 M.F. each from .0018 M.F. to .009 M.F. Especially designed to prevent corona losses and brush discharge. Oil included. Ship. wt., 35 lbs. Price. \$25.00

Wireless Spark Coils



For use on dry cells or storage batteries. Properly adjusted the half inch coil has a sending range of from 2 to 5 miles, the one in. coil 5 to 10 miles. Ship. wt., 6 and 8 lbs. \$3.95
63S5126 — Half inch coil.....\$3.95
63S5127 — 1 inch coil.....\$5.95

Spark Coil Transmitting Condenser



63S5348 — Designed for use with spark coil sets. Dielectric of 5—size, 5 x 7 photo plates. Mahogany finished case. Permits working on 200 meter wave. Ship. wt., 8 lbs. Price. \$1.48

Kick Back Preventer



63S5358 — Prevents high frequency surges from discharging back into power line. Two 1000-ohm resistance rods. Mahogany finished base. Connections of strip copper. Ship. wt., 4 lbs. Price. \$4.80

Commercial Type Oscillation Transformer



turns No. 5 wire. Woodwork. Two helix clips included. Ship. wt., 26 pounds. Price. \$16.95

Murdock Oscillation Transformer



63S5155 — Permits sharp tuning on 200 meter wave. Can be used on sets up to 1 K.W. Primary and secondary windings of edgewise wound copper ribbon. Coupling varied by hinge. Ship. wt., 8 lbs. Price. \$5.00

Double Action Wireless Key



63S5356 — Double action which makes for speed. Will improve your sending and lends individuality. Large standards, formica knob, heavy silver contacts suitable for use up to 2 K.W. Mounted on durable and heavy formica base. Metal parts nickel plated. Ship. wt., 1 1/4 lbs. Price. \$4.65

Steel Lever Keys

Ship. wt., 14 oz. 63S1739 — Leg Key with legs to go through table or desk. Price, each.....\$2.15

63S1741 — Legless Key to screw to top of table or desk. Price, each.....\$2.10

Universal Spark Gap Motor
63S5624 — A rugged high grade motor for spark gaps, running sewing machines, fans, small lathes, buffers, emery wheels, etc. Running idle will make 8,000 R.P.M. Will make about 4,500 R.P.M. with electrodes shown below. Will operate on 100-125-volt A.C. or D.C. current. Black enamel finish. Height over all, 5 1/2 in. 1/4 in. shaft, extends 7 in. Will develop about 1/20 H.P. Supplied with 1-in. grooved pulley. Ship. wt., lbs. Price. \$9.50

Spark Gap Electrodes

63S5625 — Saw tooth rotor, 5 1/2 in. diam., machined cast aluminum with bakelite center and brass bushing to fit 1/4 in. shaft. Two adjustable stationary electrodes. This set, together with universal motor listed above, mounted on a substantial base will make a high grade rotary spark gap. Ship. wt., 1 1/2 lbs. Price. \$4.50

Clear Tone Rotary Spark Gap
63S5167 — Specially made for us by or of the leading manufacturers. A high grade enclosed motor driven gap.

Improved saw tooth. Cast aluminum accurately machined 5 1/2 in. diam. 16 point rotor with bakelite center as illustrated above. Adjustable well insulated stationary electrodes. Cast aluminum enclosure 8 inches high, 3 inches wide. High grade high speed 110 volt universal motor mounted on case. Smooth running and reliable in either horizontal or vertical position. Ship. wt., 7 lbs. Price \$26.50

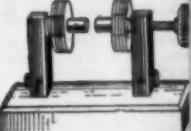
63S5168 — Same as above, without motor but with pulley for driving. Price. \$19.50

Zinc Spark Gap



63S5350 — For use with spark coil transmitter. Base is moulded composition. Metal parts all plated and polished. Can be used with coils up to 4 inches. Shipping weight 2 pounds. Price. \$1.00

Radiator Spark Gap



63S5351 — Micrometer adjustment. Electrodes of zinc. Cooling vanes aluminum. Metal parts nickel plated. Base glazed porcelain. Will handle over 1 K.W. Wt., 2 lbs....\$2.25

Standard Wireless Key

63S5352 — A high grade key made of heavy lacquered brass. Large hardened contact points. Ship. wt., 1 lb. Price. \$3.40

Montgomery Ward & Co.
Satisfaction Guaranteed or Your Money Back

CHICAGO, ILL. KANSAS CITY, MO.

Send Your Order to House Nearest You.

Our Chicago Store



MONTGOMERY

Large Stocks-Prompt Shipment

Indicating Dials and Knobs



Marconi Gov. New Reg. Ideal

Made of moulded black composition. Edges of dials are beveled, radial lines and figures are engraved in and filled with contrasting brilliant white enamel. $\frac{1}{8}$ in. thick.

63S5655—3-inch Dial only. Price... 69c
63S5657—3-in. dial with 1 $\frac{1}{2}$ in. government bakelite knob. Price..... \$1.14
63S5659—3 $\frac{1}{2}$ -in. dial only. Price... 88c
63S5661—3 $\frac{1}{2}$ -in. dial with 1 $\frac{1}{2}$ in. government bakelite knob. Price... \$1.45

Black Composition Knobs
Ship. wt. 4 oz. each. Per doz. 1 $\frac{1}{2}$ lbs.
63S5665—Marconi style, 1 $\frac{1}{2}$ in. diam. Hole for $\frac{1}{8}$ in. rod. Each. 15c. Per dozen..... \$1.18
63S5667—Marconi style 2 $\frac{1}{2}$ in. diam. Hole for $\frac{1}{8}$ in. rod. Each. 23c. Per dozen..... \$2.45

New government style. Has brass bushing for 10/32 thread and two holes for stay pins.

63S5669—Diam. 1 inch. Each. 12c
Dozen..... \$1.30
63S5671—Diam. 1 $\frac{1}{2}$ inch. Each. 15c
Dozen..... \$1.58

63S5673—Regulation 1 $\frac{1}{2}$ -inch knob with bushing. Each. 11c. Dozen. \$1.08
63S5675—Ideal 1 $\frac{1}{2}$ -inch knob metal bushing for $\frac{1}{8}$ rod with set screw. Each. 23c. Dozen..... \$2.65

Grade M. Formica Panels

Black sheets. Both sides polished. Water-proof, strong, lasting. Ship. wt. 2 to 8 lbs. Size given is in inches.

63S5688—7x9 $\frac{1}{2}$. Price..... \$0.69
63S5690—14x18 $\frac{1}{2}$. Price..... 2.45
63S5692—7x9 $\frac{1}{2}$. Price..... 1.05
63S5694—14x18 $\frac{1}{2}$. Price..... 3.90
63S5696—7x9 $\frac{1}{2}$. Price..... 1.37
63S5698—14x18 $\frac{1}{2}$. Price..... 5.25

Binding Posts and Switch Points



A Made of brass nickel-plated. Binding posts have $\frac{1}{8}$ inch long 6/32 screws with washers. Switch points have $\frac{1}{8}$ in. screws or shanks threaded 6/32. Ship. wt. per doz. 12 oz.
63S5636—Binding Post "A." Length. $\frac{1}{4}$ in. Each. 10c. Dozen..... \$1.08
63S5638—Binding Post "B." Length. $\frac{1}{2}$ in. Each. 12c. Dozen..... \$1.28
63S5644—Binding Post "C." With bakelite knob. Each. 12c. Dozen..... \$1.38
63S5646—Switch Point "D." $\frac{1}{4}$ x $\frac{1}{4}$ head with soldering lug. Per dozen..... 40c
63S5648—Switch Point "E." Head $\frac{1}{4}$ in. diam. $\frac{1}{4}$ in. high with 2 nuts. Doz. 45c
63S5650—Switch Point "F." Head $\frac{1}{4}$ x $\frac{1}{4}$ with two nuts. Dozen..... 48c

Tin Foil

63S5680—Tin Foil for making condensers. Heavy sheets, size, 6 $\frac{1}{2}$ x8 $\frac{1}{2}$ in. About 25 sheets to the pound. Per pound..... 40c

ORDER DIRECT FROM THESE PAGES

These prices are guaranteed against any advance until July 1st, 1921. It will pay you to keep this issue of QST and order from these pages at any time you are in need of additional equipment. Write your order on any plain piece of paper, giving article number and enclose money order or bank draft covering price of apparatus ordered plus parcel post charges. Figure up the total weight of apparatus ordered and ask your postmaster what postage will be required. Send your order to our Chicago or Kansas City Store, whichever is nearest you.



Switch Levers

Smooth in operation, always perfect contact without binding. Black composition knobs, diam. 1 $\frac{1}{4}$ in. Metal parts of brass nickel-plated. Ship. wt. 4 oz. 63S5651—Complete knob, laminated lever and screw permitting mounting on panels not over $\frac{1}{2}$ inch thick. Each.... 46c
63S5653—Complete knob, spring lever, shaft, two lock nuts and bushing for panels up to $\frac{1}{2}$ inch thick. Each... 49c



Variometer

63S5640—This is the same high grade variometer that is used in our Regenerative set. With two variometers, a loose coupler and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately for grid and plate tuning. Designed for very low dielectric losses and maximum range of inductance. Rotating element contacts made through shaft so that ball may be continuously rotated without breaking connection. Ship. wt. 2 $\frac{1}{4}$ pounds. Price..... \$4.95

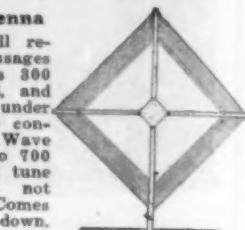
Loose Coupler

63S5642—The same high grade loose coupler used in our Regenerative set. With a loose coupler, two variometers and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately. Primary has seven taps which can be connected up to vary inductance. Secondary rotates. Connections are made through shaft. Ship. wt. 3 $\frac{1}{2}$ lbs. Price..... \$5.95

Murdock Improved Antenna Switch



63S5113—Suitable for use on sets up to 1 K.W. Mahogany finish base. Improved support, copper blades. Fitted with third blade to disconnect receiver when sending. Ship. wt. 2 $\frac{1}{2}$ lbs. Price..... \$4.50



Loop Antenna

63S5651—Will receive messages from stations 300 miles distant, and much farther under favorable conditions. Wave length 175 to 700 meters. Will tune out stations not wanted. Comes knocked down. Complete with brass plates and screws for holding arms in position, brass disc and socket for mounting on table, graduated dial for direction finding and complete instructions for assembling and using. Ht. 44 in. 100 ft. of No. 14 or smaller, bare copper wire is required. Ship. wt. 5 lbs. Price without wire..... \$4.50

Antenna and Copper Wire

Supplied only in size coils listed.
63S5150—Aerial cable. Composed of seven strands No. 22 B. & S. gauge hard drawn copper wire. Ship. wt. 6 lbs. per 100 feet.
50 feet, 58c. 100 feet, 94c. 500 feet, \$3.95.
63S5151—Bare copper wire No. 14 gauge. 50 feet, 29c. 100 feet, 47c. 500 feet, \$1.90.
63S5152—Bare copper wire No. 12 gauge. 50 feet, 49c. 100 feet, 77c. 500 feet, \$3.10.

Knife Switches

Porcelain base switches. Contacts and blades made of heavy copper. Intended for low voltage currents, but can be used on 125 volt current to carry load not over 15 amperes.

63S2644—Single pole, single throw switch. Base, size, 1 $\frac{1}{4}$ x3 $\frac{1}{2}$ in. Each..... 24c
Ship. wt. 6 oz.

63S2646—Single pole, double throw switch. Base, size, 1 $\frac{1}{4}$ x3 $\frac{1}{2}$ in. Ship. wt. 10 oz. Each..... 37c

63S2687—Double pole, single throw switch. Base, size, 2x2 $\frac{1}{2}$ in. Ship. wt. 10 oz. Each..... 39c



63S2689—Double pole, double throw switch. Base size, 2 $\frac{1}{2}$ x4 in. Ship. wt. 1 lb. Each..... 54c

Ground Switch

63S5359—600 volt, 100 amperes, double throw, single pole switch on insulating base. For grounding aerial when not in use. Ground wire should be 6 gauge. Ship. wt. 5 lbs. Price..... \$4.85

Montgomery Ward Co.

Satisfaction Guaranteed or Your Money Back

CHICAGO, ILL. KANSAS CITY, MO.
Send Your Order to House Nearest You.

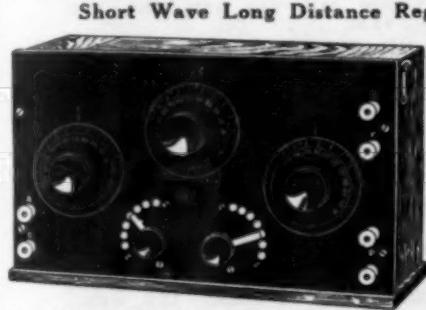
Y AVAILABLE

WARD & CO.

Our Kansas City Store

See Instructions for Ordering on Opposite Page.

These Prices Guaranteed Against Advance Until
JULY 1st, 1921.



Short Wave Long Distance Regenerative Receiver

This instrument makes possible the reception of messages to which other types of apparatus will not respond. The range is from 180 to 600 meters and by the addition of external loaders, such as the inductance coils listed on the opposite page, this range may be raised as desired. Properly handled, signals may be read from stations at extreme distances or through heavy static and interference. The antenna and closed circuits are inductively coupled and the coupling is variable. Regeneration is obtained by tuning both the grid and plate circuits to resonance with the incoming signal. Highest efficiency and amplification are obtained by reducing capacity and resistance in circuits to absolute minimum and best regenerative effects are secured by use of properly designed variometers.

The inductive coupler consists of a primary, the inductance of which is varied by two seven point switches, and a rotating secondary by means of which arrangement very fine tuning is possible. Coupler and both grid and plate circuit variometers are fitted with knobs and indicating dials. A very compact and easily portable instrument. Graduated bakelite panel size $7\frac{1}{4} \times 13\frac{1}{8}$ in. Fine cabinet weathered oak finish, 5 inches deep. Metal parts brass. Binding posts black oxidized finish. Ship. wt., 26 lbs. \$35610—Regenerative Receiver. Price.....



Rubber Covered Copper Wire



Solid conductor copper wire, insulated with rubber compound over which is one cotton saturated braid. Ship. wt., 3 and 18 lbs. per 100 ft. Sold only in lengths listed.

63R3015—Size 14. Price for 25 ft. \$0.38
Price for 100 ft. 1.40
63R3032—Size 6. Price for 10 ft.69
Per 25 ft.... \$1.73 Per 100 ft.... 5.80

Twisted Pair Cotton Lamp Cord



Two conductor, twisted New Code Lamp Cord. Conductors consist of fine copper wire strands twisted together. Covering is of fine quality interwoven yellow and green cotton. Ship. wt., 6 lbs. per 100 ft. Sold only in lengths listed.

63R3175—Size 18. Price for 10 ft. \$0.30
per 25 ft.... \$0.69 Per 100 ft.... 2.60

Porcelain Tubes



Un glazed Porcelain Tubes, $\frac{1}{8}$ in. inside; $\frac{1}{4}$ in. outside. Length given is from underend to end. Ship. wt., per dozen, 1 to 2 lbs.

63S3902—Length 3 in. Per dozen.... \$0.22
63S3906—Length 6 in. Per dozen.... .43
63S3908—Length 8 in. Per dozen.... .70

Unglazed Porcelain Cleats



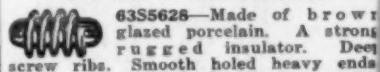
Take No. 10 or smaller wires. Have $2\frac{1}{2}$ in. wire centers. Ship. wt., per dozen pair, 3 lbs. 63R3923—2 wire cleats. Price per dozen..... \$0.37

Solid Porcelain Knobs



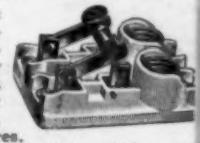
New Code No. $5\frac{1}{2}$ solid porcelain knob. Height, $1\frac{1}{4}$ in. Diameter, $1\frac{1}{4}$ in. Hole, $\frac{1}{4}$ in. Groove, $\frac{1}{8}$ in. Ship. wt., per 100, $11\frac{1}{2}$ lbs. 63S3927—Per doz..... \$0.30
No. 4 solid porcelain knob. Height, $1\frac{1}{2}$ in. Diameter, $1\frac{1}{2}$ in. Hole, $\frac{3}{8}$ in. Groove, $\frac{3}{16}$ in. Ship. wt., per 100, 20 lbs. 63S3929—Per doz..... \$0.40

Porcelain Strain Insulator



63S5628—Made of brown glazed porcelain. A strong rugged insulator. Deep screw ribs. Smooth holed heavy ends. Ship. wt., 6 oz. Each..7c Dozen..79

Porcelain Entrance Switch



National Electric Code Standard Porcelain Base Entrance Switch or main line cut-out switch. Takes plug fuses. Capacity, 125 volt, 30-amperes. 63S4305—Two-Pole Switch. Ship. wt., $1\frac{1}{2}$ lbs. Base, size, $3\frac{1}{4} \times 5\frac{1}{4}$ in. Price, each..... \$0.50



Magnet Wire

For repairing motors, other electrical apparatus, experimental work, etc. One piece only on a spool. Wire is standard B and S gauge. Insulation and wire both perfect and uniform. Supplied only on weight spools given.

Double Cotton Covered Magnet Wire	Order by Art. No.	Enamelled Magnet Wire	Order by Art. No.
Price	Price	Price	Price
4 oz.	8 oz.	4 oz.	8 oz.
Spool	Spool	Spool	Spool
\$0.79	\$1.25	16	\$0.83 \$0.98
....	.89	14	.... .65 1.10
....	1.05	18	.... .81 1.14
\$0.78	1.28	20	.... .83 1.20
.93	1.58	24	\$0.62 .96 1.25
1.05	1.80	26	.65 1.02 1.32
1.25	2.10	28	.68 1.06 1.42
1.48	2.58	30	.78 1.20 1.48
1.78	3.15	32	.81 1.25 1.56
1.98	3.70	36	.96 1.48 1.98

Electrose Insulators



Electrose insulators are the standard in wireless field. They stand up under all conditions met with. Eyes are wrought iron vaned. Ship. wt., $\frac{1}{2}$ to $2\frac{1}{2}$ lbs.

Article	Dia.	Ov.	All Strgth.	Elec. Value
No.	In.	In.	Lbs.	Dry Volt Rain
63S5630	$2\frac{1}{2}$	$3\frac{1}{4}$	250	40,000 25,000
63S5631	$1\frac{1}{2}$	4	1,000	40,000 15,000
63S5632	$1\frac{1}{2}$	$10\frac{1}{2}$	1,000	90,000 50,000

Electrose Wall Insulators

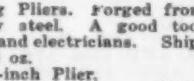
63S5634—Special Wall Insulator for lead in wires. Has hole through body for wire. Body diam., 2 in. Length over all, $5\frac{1}{2}$ in. Ship. wt., 1 lb. Price..... .96c



Sharp Nose Side Cutter Plier
A high grade Hardened Steel Plier. Used on all electrical work. Handy around any work shop. Ship. wt., 6 oz. 63S5802—6-inch Sharp Nose Plier. Price, each..... \$1.28



Diagonal Jaw Plier
Best Hardened Tool Steel Diagonal Jaw Sidecutting Nipper. This tool will do perfectly the work for which it is intended. Length, 5 in. Ship. wt., 4 oz. 63S5808—Diagonal Jaw Pliers. Price, each..... \$1.35



High Grade Pliers
Side cutting Pliers. Forged from best quality steel. A good tool for linemen and electricians. Ship. wt., 4 to 10 oz.
63S5810—5-inch Plier. Price each..... \$1.12
63S5812—6-inch Plier. Price, each..... 1.18
48c 63S5814—7-inch Plier. Price, each..... 1.42

CHICAGO, ILL. KANSAS CITY, MO.
Send Your Order to House Nearest You.

Montgomery Ward & Co.
Satisfaction Guaranteed or Your Money Back

February, 1921

CALLS HEARD

(Continued from page 58)

8AEE, 8AKU, (SAKV), SAY, SAMQ, 8BP, 8CFN,
 8CF, (8DV), SDZ, SDP, SDJ, 8EV, SEM, SFI, 8GW,
 8GL, SHG, 8HL, (SHA), SIN, 8IK, SIL, 8IZ, 8JJ,
 8JS, 8FJ, SKR, 8KZ, (8KP), 8LF, 8LB, 8ML,
 8MT, SNZ, SQJ, SRZ, (8SP), 8TI, 8UK, 8VJ,
 (8WY), SKX, SXH, SZR, 8ZG, (8ZD), SZL, 8ZA,
 SZX, (8ZY), 9AK, (9AF), 9AUN, 9AGY, 9AMK,
 9EN, 9FG, 9FT, 9FN, 9GE, 9GN, 9GL, 9GC, 9GX,
 9HN, 9HR, 9HJ, 9JT, 9JL, 9JQ, 9JN, 9KV, 9LF,
 (9LQ), 9LT, 9MC, 9NJ, 9NQ, 9OE, 9OR, 9PL,
 9QX, 9QM, (9UH), 9UU, 9UK, 9ZB, 9ZN, 9ZJ,
 9ZQ, 9ZL, 9ZI.

3CA, ROANOKE, VIRGINIA—December.
IAE (C.W.), 1BBL, 1GBC, 1HAA, 1JS, 1MW,
IRAY, 1RZ (spark and C.W.), 1TS, 1XT, 2AM,
2BB, 2BK, 2DA, 2HN, 2JJ, 2JU, 2OA, 2OM, 2QW,
2TF, 2ZL (phone), 3AAP (dalite), 3ACB, 3ACE,
3ACS, (3AHK), 3BZ, 3CC, 3CM, 3EH, 3GN, 3FA,
3FG, 3GO, 3GX, 3HJ, 3MO, (3OB), 3OC, 3PU,
3KA, 4AI (C.W. and spark), 4AL, 4AO, 4AU, 4BA,
4BK, (4YB), 5AN, (5DA), 5ER, 5YH, 5ZS, 5AB,
5AAG, 5AAU, 5ACF, 5AGB, 5AIB, 5APB, 5AVK,
5AY, 8BP, 8CD, 8CF, 8CH, 8CO, 8DG, 8EC, 8EF,
8EK, 8EV, 8FT, 8GL, 8GQ, 8HA, 8HS, 8ID, 8IN,
8JF, 8JJ, 8JS, 8KP, 8ML, 8MM, 8NH, 8NI, 8OW,
8RQ, 8SI, 8SP, 8TJ, 8TK, 8TO, 8VY, 8WY, 8ZA,
8ZL, (8ZR), 8ZV, 8ZW, (8ZY), 8ZZ, 9ABL,
9AEG, 9AK, 9AMV, 9AOJ, 9BW, 9BY, 9EQ, 9FG,
9FQ, 9FS, 9GS, 9JJ, 9JN, 9QY, 9LQ, 9LR, 9MC,
9MH, 9OE, 9UK, 9WZ, 9ZJ, 9ZQ, 9ZZ.

3SU, WASHINGTON, D. C.—Nov. 15 to Dec. 15.
 1AGW, 1AK, 1AW, 1BB, 1BBL, 1BM, 1CK, 1CZ,
 1EAV, 1GBC, 1GY, 1HAA, 1JAP, 1JQ, 1KA,
 1OB, 1OW, 1PG, 1PQ, 1RZ, 1XT, 2AN, 2AR, 2BB,
 2BG, 2BK, 2BM, 2CS, 2CY, 2DA, 2DH, 2DS,
 2EL, 2HN, 2JF, 2JN, 2JU, 2JZ, 2NF, 2PL, 2RK, 2TF,
 2UE, 2WB, 2XG, 2ZL, 3AA, 3AAP, 3AAS, 3AB,
 3ABC, 3ABD, 3ACM, 3AFG, 3AHK, 3AJ, 3BE,
 3BS, 3BZ, 3CA, 3CC, 3CX, 3DH, 3DS, 3EH, 3EN,
 3FB, 3FG, 3FM, 3GO, 3HG, 3HH, 3HJ, 3HX,
 3KV, 3PU, 3RS, 3SC, 3SW, 3SX, 3TC, 3VV, 3YV,
 3ZA, 4AG, 4RS, 4AO, 4BC, 4CP, 4DM, 4EY, 4YB,
 5DA, 5EY,
 5FV, 5KD, 5XA, 5YE, 5AAU, 5ACA, 5ACF,
 5ACH,
 5ADY, 5AFB, 5AFD, 5AIG, 5AJM, 5AJW,
 5AKA,
 5AKV, 5AL, 5AMF, 5ANJ, 5AY, 5BP, 5CH,
 5CL,
 5DM, 5DR, 5DW, 5DZ, 5EF, 5EN, 5FC,
 5FK, 5FO,
 5FP, 5FT, 5FY, 5GB, 5GI, 5GW, 5HA, 5HF,
 5HP,
 5HY, 5ID, 5IK, 5IN, 5JF, 5JJ, 8JS, 8JU,
 8KE,
 8KP, 8LF, 8LG, 8LH, 8LW, 8ML, 8MT,
 8MW,
 8MZ, 8NL, 8NN, 8NZ, 8OM, 8PN, 8PU,
 8QM, 8QT,
 8RQ,
 8RW, 8SH, 8SP, 8TT, 8VK, 8VQ,
 8WD,
 8WY, 8XE, 8XK, 8XS, 8XU, 8ZA, 8ZD, 8ZE,
 8ZL,
 8ZR, 8ZT, 8ZZ, 8ZX, 8ZY, 8ZZ, 9AAF,
 9AP, 9BW,
 9DV, 9EQ, 9ET, 9FG, 9FS, 9GC, 9GP,
 9GX, 9HN,
 9HR, 9JT, 9JV, 9KV, 9LF, 9LQ, 9QM,
 9OX,
 9SS,
 9UE, 9UH, 9UU, 9VA, 9ZJ, 9ZL, 9ZN.

4FD, MIDVILLE, GA.—November.
1AW, 2HN, 2RK, 3AC, 3AP, 3BG, 3BL, 3EH,
3EL, 3EN, 3JU, 3KM, 3WH, 3VY, 3AAP, 4AG,
4AI, 4AL, 4AM, 4AN, 4AO, 4BL fone, 4BM fone,
4BQ, 4CP, 4DA, 4YB, 5AO, 5BY, 5DA, 5EA, 5ER,
5FV, 5LL, 5LP, 5YH, 5AC, 5AY, 5DI, 5DP, 5DR,
5DW, 5ER, 5EY, 5FI, 5FT, 5FY, 5GO, 5GX, 5HA,
5KE, 5LA, 5LD, 5LE, 5LL, 5LN, 5LQ, 5LX, 5LY,
5ML, 5NL, 5OE, 5OX, 5SF, 5TT, 5AAF, 5ACF,
5AF, 9BW, 9DV, 9ET, 9FT, 9GK, 9GN, 9GT, 9GX,
9HA, 9IF, 9LF, 9LL, 9LN, 9LQ, 9LR, 9OE, 9OL,
9UM, 9VS, 9WA, 9ZJ, 9ZJ, 9AAF, 9AAW, 9ABS, 9ACF,
9ACN, 9AEQ, 9SF fone & C.W., KQG fone, 8XE
fone.

4CX, WINSTON-SALEM, N. C.

Oct. 1 to Dec. 12.

1BM, 1RK, 1XT, 1XB, 2RK, 2ZM, 2XH, 2ACM,
 2HL, 2ZL, 2XQ, 2KF, 2ZR, 2ZH, 2WB, 2HG, 2FG,
 2GO, 2XG, 2BB, 2XQ, 2AER, 2KM, 2AR, 2XF,
 3KM, 3DH, 3XF, 3UC, 3QW, 3RO, 3GO, 3QV,
 3AAG, 3FR, 3HG, 3AHK, 3HB, 3HJ, 3PU, 3SW,
 3SM, 3FG, 3PF, 3VV, 3YV, 3TJ, 3HX, 3FM, 3DR,
 3EN, 4CC, 4BQ, 4KC, 4XK, 4YB, 4CP, 4AG, 4XC,
 4AO, 4DM, 4BY, 4EK, 4DA, 4BC, 4AN, 4BE, 4XA,
 5ZL, 5DA, 5YE, 5KD, 5YH, 5XB, 5ER, 5FV, 5ZZ,
 5ZG, 5JA, 5ZK, 5XK, 5ER, 5HG, 5RW, 5HR, 5ZG,
 5ZW, 5ZA, 5YV, 5SP, 5HA, 5DL, 5BP, 5HH, 5SO,

SUO, SOM, SAGS, SIL, 8JF, 8QJ, SAOU, 8HT,
SKV, SIN, SLX, SZX, SZY, SPN, SUC, SDA, 8XK,
SACF, SZR, SZV, SJS, 8AAU, 8GW, 8PT, 8ZE,
8FD, 8DV, 8ZD, 8TI, 8ADV, 8AL, 8IK, 8DJ, 8AFB,
8QM, 8AAZ, 8FT, 8YR, 9LM, 9ZO, 9ZL, 9AEQ,
9YJ, 9LQ, 9ZJ, 9QM, 9BW, 9ADI, 9VA, 9DJ, 9ZN,
9JN, 9WZ, 9GJ, 9DF, 9YC, 9YA, 9PC, 9PD, 9YD,
9AEQ, 9VC, 9UH, 9LQ, 9QJ, 9XM, 9NQ, 9YD,
9AEQ, 9ABL, 9YB.

4BP, JACKSONVILLE, FLA.—Oct. 8 to Nov. 8.
 1AW, 1JZ, 2BB, 2EL, 2PG, 2RK, 2ZC, 2ZL Mod.
 C.W., 3AM, 3BZ, 3EZ, 3FG, 3GO, 3HG, 3HJ, 3JK
 3KM, 3OB, 3RF, 3SX, 3VV, 3ZW, 4AG, 4AI C.W.
 4AL, 4BI, 4BQ, 4BY, 4CP, 4CS, 4DW, 4DX, 4EK
 4XC, 4YB, 5AO, 5CG, 5DA, 5ER, 5FV, 5VH, 5XA
 5YH, 5ZL, 5ZF, 5ZT, 5ZZ, 5AC, 5ACF, 5CB, 5DD
 5DP, 5DZ, 5ER, 5GW, 5HH, 5RQ, 5SH, 5SP, 5XK
 5ZD, 5ZM, 5ZV, 5ZW, 5ZYL, 5ZYL, 5ZYL, 5ZYL
 C.W. speech and music, 5ZD, 5ZL, 5ZWL, 5ZYL
 8ZY, 9AEQ, 9AOJ, 9AP, 9BW, 9DW, 9GN, 9GX
 9LQ, 9VA, NSF Mod. C.W. and phone.

5ZP, NEW ORLEANS—Oct. 1st to Jan. 15.

2JU, 2RK, 2RV, 3BZ, 3CA, 3CC, 3DH, 3GO, 3YB,
3YV, 3ZE, 3ABC, 4AL, (4AG), 4AN, (4AO), 4BQ,
(4BY), 4CG, 4CP, 4DW, (4EK), 4XB, (4XC),
4YB, 5AG, 5AL, (5BI), 5BM, (5BO), (5BT),
(5CA), 5CD, (5CG), (5DA), 5DO, 5DW, (5EA),
(5ED), (5EJ), 5EL, 5EO, 5EP, (5ER), 5EW,
5EY, (5FL), 5HR, 5HI, 5HV, 5JA, (5JD), (5JE),
(5XA), (5XB), 5YE, 5YL, (5YH), 5YM, (5ZA),
(5ZC), 5ZF, 5ZG, 5ZJ, (5ZK), (5ZL), 5ZN,
(5ZS), 5ZT, (5ZU), 5ZV, 5ZW, (5ZX), 6IG, 6ZH,
6JT, 8AO, 8AY, 8BO, 8BP, 8DA, (8DI), 8DQ,
8DV, (8DZ), 8EC, 8ER, 8FK, (8FT), 8GL, 8HA,
8HG, 8HR, 8ID, 8IK, 8IV, 8JE, 8JF, 8JJ, 8JQ,
8JR, 8KP, 8L, 8OL, 8OJ, 8ON, 8PN, 8QJ,
8SQ, 8SP, 8TQ, 8TT, 8VJ, 8WY, 8XC, 8XK,
(8ZD), (8ZE), 8ZJ, 8ZL, 8ZF, 8ZR, 8ZT, 8ZV,
8ZW, (8ZY), 8ADE, 8ADV, 8ACF, 8AFX, 8AVK,
8AN0, 8ARW, 9AE, 9AJ, 9AP, (9AT), 9AU, 9BL,
9BP, 9BR, 9BT, 9BW, 9BY, (9CA), 9CP, 9DF,
9DT, 9EA, 9EL, 9EQ, (9FU), (9GC), 9GN, 9GS,
9HA, 9HI, 9HJ, 9HM, 9HN, 9HR, 9HY, 9JK,
(9JN), 9JQ, 9JT, 9KO, 9KV, 9LA, 9LF, 9LG,
(9LM), 9LQ, (9LR), 9LW, (9NG), (9NQ), 9OE,
(9OX), 9PV, 9QM, 9QR, 9RK, 9SS, 9UU, 9UK,
9UU, 9VS, 9WS, 9WU, 9WZ, 9XW, 9YA, 9YC,
9YL, 9YM, 9YY, (9ZB), 9ZJ, 9ZL, 9ZM, 9ZN,
9ZP, 9ZQ, 9ZW, 9ZV, 9ZZ, (9AAC), 9AAV, 9AAW,
9ABI, 9ABL, 9ABX, 9ACB, 9ACH, 9ACJ, 9ACN,
(9AEG), (9AEQ), 9AEU, 9AEY, 9AEZ, 9AFX,
9AG, 9AKC, 9AKH, 9AMV, 9ANP, 9AOJ, 9ARW,
9ASU, 9ATL, 9AUX, 9AWX.

SYE, UNIVERSITY, MISS.—Nov. 15 to Dec. 15.
 2BH, 2JU, 2WB, 3AHK, 3DH, 3FG, 3GO, (4AG)
 4BQ, 4BY, 5DA, 5EA, 5ED, 5ER, 5HL, 5JE, 5XA,
 (5XB), (5YH), 5YK, 5ZA, 5ZC, 5ZL, 5ZP, 5ZS,
 5ZW, 5ZZ, 8AB, 8AEF, 8AJ, 8ANO, 8CP, 8DP,
 8DZ, 8FI, 8GO, 8GW, 8HA, 8IN, 8JJ, 8KP, 8LX,
 8QJ, 8RW, 8SP, 8WY, 8WZ, 8YA, 8YE, 8ZE,
 8ZD, 8ZL, (8ZR), (8ZV), 8ZW, 8ZY, 9AAV,
 9AACN, 9AEG, 9AFX, 9AHs, 9AJ, 9AKF,
 9AMV, 9AN, 9AO, 9BS, 9BW, 9EQ, (9FS), 9GN,
 9GX, 9HI, 9HM, 9ID, 9JN, 9JQ, 9JU, 9LE, 9LM,
 9LQ, 9PE, 9UH, (9XM), 9YC, 9ZJ, 9ZL, 9ZQ,
 9ZR, 9ZV, (NSF).

RADIO SEA, BATON ROUGE, LA.

November 15 to December 15.

1IRJ, 2NJY, 3GO, 3SW, (3ZO), 4AG, 4AI, 4AN,
4BK, 4BQ, (4CP), 4GC, 4WE, 5BC, (5BI), 5BO,
5BS, 5CG, 5DA, 5ED, 5EF, 5EO, 5ER, 5GT, 5HK,
(5HL), (5JE), 5KP, 5XA, (5XB), (5YE), (5YH),
5YM, 5ZA, 5ZC, 5ZF, (5ZG), 5ZK, (5ZL), (5ZN),
5ZP, (5ZS), (5ZU), 5ZV, 5ZW, (5ZZ), 8AD, 8DC,
8DI, 8DL, 8IK, 8JF, 8KI (C.W.), 8WP (C.W.),
8ZC, 8ZL, 8ZN, 8ZR, 8ZV (C.W.), 8ZY (Spk. and
fone), 9AQ, 9ABI, 9AEQ, 9AEQ, (9AEY), 9AFX,
9AKC, 9AMV, 9BT, 9BW, 9DE, 9EQ, 9EY, 9FU,
9FS, 9HN, 9HR, 9ID, 9JN, 9IQ, 9KQ, 9KV, 9LC,
9LF, 9LJ, 9LM, (9LQ), 9LR, 9LU, 9LW, 9MH,
9OE, 9QJ, 9SN, 9SH, 9VA, 9VC, 9WQ, 9WT, 9ZQ,
9YM, 9YA, 9VY, 9ZF, 9ZI, 9ZO, 9ZO, NSE.

6ZA, SALT LAKE CITY—Nov. and Dec.
8ZB, 7ZI, 9LR, 9HT, 9IF, (6EJ), (6AN), (6AK),
(6JD), 5ZC, (6PJ), (6JM), 6JI, (6IG), 5ZJ

(6ZH), (6AH), (6BQ), (7CC), 6FS, 9AEG, 9OE, 6BN, 9ER, 6KL, (6EB), 6KP, 6PR, 6CT, (6JR), (6EA), 7BQ, 6OH, 6JN, (6BJ), (6DP), 6JT, 6ZE, 6ZK, 6JC, 6EN, 7ZI, 7IM, 7ZJ, 7GO, 6NH, 6PO, 6IC, 9IF.

6AE, STANFORD UNIVERSITY, CALIF.
 (6AK), 6BQ, (6CT), (6CU), 6CV, 6DH, (6DP), (6EA), (6EB), 6EC, (6EJ), (6EL), 6EN, (6ER), (6FR), 6FI, 6FS, (6FT), 6GC, 6GE, 6GF, 6GN, 6HK, (6HY), 6IF, 6IC, (6IG), 6IH, (6IL), (6IY), 6JC, (6JD), (6JM), 6JQ, (6JT), 6KA, 6KE, (6KM), 6KP, 6KS, 6HZ, 6NY, (6OH), (6OL), 6OT, (6PE), 6PQ, (6PR), 6QM, (6QR), (6SK), 6TC, 6TX, 6UM, 6UO, 6XC, 6XZ, 6ZA, 6ZB, 6ZL, 6ZM, (6AAK), (6AAT), 7AD, 7BH, (7BP), (7CC), 7CE, 7CR, (7CW), (7CU), (7DA), 7ED, (7GQ), 7GY, 7HN, 7IM, 7IN, 7KO, 7NY, (7YA), (7YS), 7ZA, (7ZB), 7ZJ.

7KX, CASPER, WYOMING—Dec. 6 to Jan. 19.
 5BL, 5CG, 5DI, 5HK, 5HL, 5IP, 5JS, 5ZA, 5ZC, 5ZG, 5BJ, 6CO, 6CV, 6EJ, 6IG, 6MD, 6MK, 6RE, 6ZA, 6ZH, 6ZO, 6AFN, 7BQ, 7EX, 7FL, 7HS, 7IM, 7XD, 7ZG, 8BP, 8ZR, 9AF, 9BQ, 9BR, 9BW, 9DV, 9DE, 9HY spk. and C.W., 9EE, 9EL, 9ET, 9EQ, 9EW, 9FI, 9FL, 9FT, 9FN, 9FU, 9GC, 9GN, 9HC, 9HD, 9HI, 9HO, 9HN, 9HM, 9IF, 9IV, 9JA, 9JG, 9JL, 9JN, 9JQ, 9JT, 9KK, 9KU, 9LC, 9LR, 9LW, 9MC, 9MH, 9MY, 9NS, 9OB, 9OE, 9OK, 9OP, 9OT, 9PI, 9RU, 9RY, 9SZ, 9UT, 9UQ, 9VL, 9YO, 9ZC, 9ZG, 9ZN, 9ZQ, 9AAW, 9AEQ, 9AEY, 9AFX, 9AIF, 9AIG, 9AJS, 9AKB, 9AMB, 9ANG, 9AOO, 9AOU, 9ARJ, 9ARV, 9AVC, 9AWG, 9AWX, 9AXC, 9AXR, 9BCO, NSF.

7ZG, BEAR CREEK, MONT.—Thru December.
 5BI, 5HK, 5HZ, 5XB, 5XD, 5YH, 5YM, 5ZA, 5ZC, 5ZG, 5ZJ, 5ZZ, 6AE, 6ACD, 6AFD, 6BQ, 6CO, 6FE, 6GT, 6IG, 6JT, 6JE, 6MK, 6QB, 6RE, 6ZA, 6ZH, 6ZK, 6ZL, (6ZN), 6VS, 6WV (C.W.), 7AMX, 7BH, 7BV, (7CC), (7EX), 7FL, 7GY, 7HS, (7IM), (7YA), 7YD, 7XB, (7XD), 7YS, 7ZB, 7ZC, 7ZJ, 7ZH, 8HA, 8HP, 8ZC, 9AO, 9AAC, 9AEG, 9AEQ, (9AEY), 9AFX, (9AGN), 9AMB, (9AIG), 9ALG, 9AOU, 9APC, 9AFB, 9ABI, 9ABX, 9AHF, 9AVZ, 9BH, 9BW, 9EE, 9EL, 9EQ, 9FZ, 9HI, 9HM, 9HT, 9IF, 9JA, 9JL, 9JN, 9JQ, 9JT, 9KM, 9LA, 9LR, 9LW, 9MH, 9NQ, 9OB, 9OE, (9PI), 9PL, 9RL, 9RJ, 9SC, 9UQ, 9VF, 9WU, 9XI, 9XM, 9XT, 9VA, 9YL, 9YO, 9YY, 9ZC, 9ZL, 9ZN, 9ZQ, 9ZT, 9ZV.

HEARD AT 8FE, BUFFALO, N. Y.

November and December.

1AW, 1AEF, 1BBL, 1BM, 1CK, 1DY, 1FAQ, 1GBT, 1GY, 1HAA, 1IAP, 1JAP, 1JQ, 1KBQ, 1OA, 1OE, 1PQ, 1PZ, 1RN, 1RQ, 1RV, 1RZ, 1SZ, 1TS, 1WP, 1XE, 1XF (C.W.), 1XQ, 1XJ, 1XV, 1YD, 1ZD, 2ACM, 2ADD, 2AER, 2AHL (C.W.), 2AR, 2AS, 2BB, 2BG, 2BK, 2BO, 2CS, 2DA, 2DN, 2DR, 2HN, 2HX, 2JE, 2JJ, 2JS, 2JU, 2JZ, 2KP, 2XX, 2MC (C.W.), 2OA, 2OU, 2OW, 2PL, 2QC, 2RB, 2RK, 2SH, 2SZ, 2TF, 2TS, 2WB, 2XH, 2XX (C.W.), 2XQ, 2ZC, 2ZD, 2ZL (C.W.), 2ZM, 3AA, 3ABC, 3ABD, 3ACM, 3ACS, 3AHK, 3BA, 3BG, 3BZ, 3CE, 3CS, 3DH, 3DR, 3DS, 3EN, 3EP, 3FG, 3GO, 3HG, 3HJ, 3HX, 3IW, 3JN, 3KM, 3MP, 3OM, 3OO, 3OU, 3PU, 3QF, 3SM, 3TA, 3UC, 3VV, 3XH, 3YV, 3ZA, 3ZW, 3NF, 3WW, 4AI (C.W. & Spk.), 4AL, 4AN, 4BQ, 4DM, 4MM, 4XB (C.W.), 4YA, 4YB, 5DA, 5XA, 5YE, 5YH, 5AB, 5ABG, 5ACF, (5ADR), 5AEE (5AMQ), (5AMZ), 5ANL, 5ANA, 5AY, 8BP, 8BY, 8CV, 8DA, 8DI, 8DR, 8DV, 8DZ, 8EC, 8EK, 8EV, 8ER, 8FC, 8FK, 8FW, 8GI, 8HA, 8HI, 8HG, 8HY, 8ID, 8IK, 8JJ, 8JU, 8JF, 8KF, 8LX, 8LQ, 8ML, 8MM, 8NI, 8WZ, 8OI, 8OM, 8PL, 8QG, 8QM, 8RQ, 8RW, 8SP, 8TT, 8UE, (8WV), 8WY, 8XE, 8XH, (8XK), 8XU, 8ZA, 8ZD, 8ZE, 8ZF, 8ZK, 8ZQ, 8ZR, 8ZW, 8ZX, 8ZY, 8ZZ, 9AAC, 9AEG, 9AJ, 9ATL, 9AU, 9BP, 9CA, 9DC, 9EE, 9EL, 9EQ, 9FG, 9FM, 9GC, 9GN, 9GP, 9GW, 9HK, 9JN, 9JT, 9KD, 9KV, 9LN, 9LO, 9LQ, 9LR, 9MK, 9MS, 9OR, 9OX, 9PN, 9UH, 9UU, 9WR, 9WZ, 9XM, 9XU, 9YI, 9ZJ, 9ZL, 9ZN, 9ZQ, 9ZV. Canadian: 3BP (C.W.), 3BT, 3CA, 3CF.

8EL, BUFFALO, N. Y.—Dec. 23 to Jan. 23.
 1AW, 1BB, 1BBL, 1CK, 1FQ, 1GBC, 1GBN, 1GBT, 1HP, 1HAA, 1OE, 1RAY, 1YB, 2DA, 2DR, 2EL, 2JU, 2OO, 2RB, 2RK, 2RL, 2TF, 2ZL (C.W.), 3BP (Can.), 3BQ, 3BZ, 3DA, 3DH, 3EN, 3GO, 3GX, 3HJ, 3QM, 3SH, 3TB, 3UC, 8AL, 8AHN,

8AHV, 8AOK, 8APB, 8BP, 8DP, 8DR, 8FM, 8FR, 8FW, 8GI, 8HP, 8JS, 8QM, 8RQ, 8SR, 8TB, 8XE, 8XU, 8ZA, 8ZD, 8ZY, 8FH, 9ZB, 9ZL, NSF (L.C.W. & C.W.), XBI (C.W.), XF1 (C.W.).

8WE, ELMIRA, N. Y.—December.
 1BA, 1BM, 1BBL, 1CB, 1CD, 1CK, 1CM, 1CBX, 1DY, 1FF, 1GBC, 1HAA, 1HBI, 1IAP, 1JQ, 1OE, 1PAO, 1RAY, 1RU, 1WR, 1XT, 1XV, 1XX, 1XF1, 7BI, 2AHK, 2AWL, 2BG, 2BQ, 2CC, 2CM, 2DA, 2FG, 2HN, 2JU, 2KM, 2OM, 2SZ, 2TF, 2TJ, 2XF, 2XQ, 2ZL, 2ZM, 3AC, 3ABC, 3ACX, 3AHK, 3CC, 3EP, 3FN, 3FR, 3GO, 3GX, 3HG, 3HJ, 3IW, 3JK, 3KM, 3OU, 3PU, 3QW, 3RW, 3SC, 3TJ, 3TJH, 3VV, 3YV, 3ZG, 4AI, 4DM, 4XB, 4YB, 5DA, 5AAG, 5AB, 5ABX, 5ACF, 5ADH, 5AFB, 5AGC, 5AJ, 5ANJ, 5ARW, 5BG, 5BP, 5CF, 5DP, 5DR, 5DY, 5EC, 5FT, 5GG, 5GH, 5GI, 5HA, 5HY, 5IK, 5IN, 8JG, 8JS, 8KE, 8KP, 8KZ, 8LG, 8LH, 8MJ, 8ML, 8NI, 8OJ, 8OY, 8PT, 8QJ, 8RO, 8RQ, 8RW, 8SH, 8SP, 8TN, 8TT, 8UF, 8WY, 8XK, 8XU, 8ZA, 8ZD, 8ZE, 8ZL, 8ZN, 8ZR, 8ZV, 8ZW, 8ZX, 8ZY, 8ZZ, 9AAW, 9AD, 9AWX, 9FN, 9GX, 9HR, 9JN, 9QJ, 9YT, 9MC, 9TH, 9UH, 9YM, 9ZL, 9ZQ.

9CA, MINONK, ILL.—December.
 1AN, 1AW, (1BL), 1DY, (1JQ), 1OE, (2BK), 1DN, 2FT, 2GR, (2HN), (2JZ), (2RK), (2RV), (2SZ), 2TF, 2TS, 2UC, 2XQ, (2ZD), 2ACM, 2ARY, 3DH, (3EN), (3GO), 3HG, (3HJ), (3HX), 3IW, 3PU, 3RJ, (3VV), 3WL, 3XF, (3ZA), 3ABB, (4AG), 4DM, 4EK, (4XC), (5AG), (5AL), (5AO), 5BI, 5CA, (5CG), (5ED), 5EF, (5EJ), 5HL, (5ZP), 5ZT, 5ZU, 6HS, 6JD, 6KA, 6OT, (6WV), 6AB, 6AT, (6AY), 6BO, 6BP, (6CF), 6CG, (6CV), (6DC), 6DV, 6FD, (6FI), (6FK), (6FR), (6FT), 6FY, 6HT, 6HM, (6ID), (6IK), 6IN, 6IV, 6JF, (6JJ), (6KM), 6LB, 6LG, (6MH), 6ML, 6NZ, (6OJ), 6PN, 6QJ, 6RQ, 6RU, (6VJ), 6VQ, 6WY, 6WZ, 6XE, (6XH), 6XI, 6XK, (6ZL), 6ZR, 6ZW, C.W., 6ZZ, 6AAZ, (6ADE), 6AFS, 6IFS, 6AJW, 6AKA, 6AKE, (6AKV), 6OIG, 9AD, 9AL, 9AU, 9AX, (9BW), 9BY fone, 9CP, 9CS, 9DF, (9DU), (9EE), (9EL), 9EK, (9EQ), 9FP, 9FT, 9FU, 9G, (9GN), 9H, 9HM, 9HN, (9HT), 9HO, 9HY, 9IF, 9IR, (9JN), 9JQ, 9KN, 9KO, (9KV), 9LC, (9LM), (9LR), 9MC, 9MH, 9MS, 9NF, (9OE), (9OX), 9PV, 9QI, 9RA, 9RG, 9RM, 9RV, (9RY), 9SV, (9TT), (9UH), 9US, (9UU), 9VL, 9WV, 9WE, 9WT, (9WU), 9XI, (9XM), 9ZB, 9ZC, 9ZJ, 9ZL, 9ZN, (9ZQ), (9ZT), 9ZV, (9AAC), 9AAF, 9AAJ, (9AAE), (9ABI), 9ABX, 9ABZ, 9ACB, 9ACJ, (9AEG), 9AEQ, 9AEU, 9AFX, 9AGY, 9AHD, 9AIK, (9AJI), (9AKC fone & spk.), 9ALI, 9ARG, 9ATL.

JOHN TERRY, COLORADO SPRINGS, COLO.

Dec. 1st to Dec. 15th.

1AW, 1HAA, 2XX (phone), 2XJ (phone), 5AT, 5XB, 5ZP, 6AAS, 7IK, 9AIF, 9RI, 9AMB, (9XE), 9AAF, 9EQ, 9LY, 9AKG, 9AEU, 9EE, 9LR, 9ZL, 9AEQ, 9JE phone.

LAFAYETTE, INDIANA (9FD)—Jan. 3 to Jan. 16.
 4AU, 4CG, 4CP, 4JE, 5DA, 5LA, 5YH, 8AG, 8AKV, 8HJ, 8HM, 8HR, 8LD, 8LZ, 8XK, 8ZAE, 8ZE, 8ZL, 8ZY, 8AAW, 9ABL, 9ADN, 9ADS, 9AEQ, 9AR, 9ASL, 9ASR, 9AST, 9AWR, 9AWX, 9EQ, 9GX, 9HM, 9KR, 9LF, 9LQ, 9RR, 9UK, 9VI, 9WZ, 9ZJ, NSF, 9WW.

9ZL, MANITOWOC, WIS.—Jan. 3d to 17th.
 1ARJ, 1AW, 1NB, (2GR), 2JU, (2RK), 2RL, (2SZ), 2TF, 2XQ, 2ZM, (2AHK), 3BH, (3CC), (3DH), 3GO, 3XF, 4AN, 4XB, 5BI, 5ER, 5HL, 5IS, 5JD, 5XA, (5XB), (5YH), 5ZP, 7EX, 7GS, 8ADE, 8AFS, 8AHR, (8AKJ), 8ANK, (8APU), 8ARW, 8CV, 8DV, 8FG, 8FK, 8FT, 8GI, 8GW, 8HA, 8HG, (8HI), 8ID, 8IK, 8JS, 8KE, 8LJ, 8ML, 8NI, 8NM, 8NZ, 8OI, (8OJ), 8RQ, 8SP, 8TV, 8VJ, 8WV, C.W., 8XE, (8XK), 8XU, (8ZL), 8ZR, (8ZT), (8ZV), 8ZW, (8ZY), 8ZD, 8AC, 8ABL, 9ABX, 9ACB, 9ACL, 9AEG, 9AEQ, 9AGN, 9AHD, 9AHS, 9AIG, 9AKM, 9AMX, 9AP, 9ARG, 9AT, 9ATL, (9AWX), 9AWG, 9BR, 9BW, 9CF, 9CS, (9EE), (9EQ), 9ET, 9FU, 9GO, (9HM), 9HR, (9JL), (9JN), (9JQ), 9KK, 9KV, 9LC, 9LM, (9LQ), (9LR), 9LW, 9MH, 9MS, 9OE, 9SS, 9UK, 9UQ, 9UT, 9WE, (9WU), (9XI), 9YB, 9YC, 9YL, 9YY, 9ZB, (9ZC), 9ZJ, 9ZN, (9ZQ), 9ZS, 9ZY, 9XM.

1RAY, BURLINGTON, VT.—December
 1AS, 1AW, 1BL, 1BBL, 1BM, (1CK), 1CM, 1CP,
 1DR, (1DY), (1EAW), (1EP), 1FN, 1FU, 1GA,
 1GBC, 1GBT, (1GM), (1GY), (1HAA), 1JJ, (1JQ),
 1JZ, 1MX, 1OW, 1OE, (1PAO), (1PG), 1SZ, 1TS,
 1TZ, 1UE, 1XG, 1XT, (1WA), 1WE, 1XF, (2AM),
 2AHK, 2AWL 2AR, 2ARA, 2BB, 2BFH, 2BK, 2BM,
 2CK, 2CS, 2CT, 2DA, 2DI, 2EN, 2IF, 2HN, 2HX,
 2JU, 2JZ, 2OA, 2OM, (2OO), 2OW, 2PL,
 2QC, (2MV), 2RK, 2TS, 2WL, (2XQ), (2XX),
 2ZC, 2ZM, (3ABC), 3AK, 3BG, 3BH, 3CA, 3CM,
 3DH, 3EH, 3EV, 3FB, 3FM, 3GO, 3HG, 3HX,
 3HZ, 3KM, 3NR, 3VV, 3XF, 3YV, 4BQ, 4YB, 5DA,
 (8ACF), 8AFB, (8AMQ), 8AMZ, 8APU, 8ARW,
 8BP, 8ED, 8EV, 8FI, 8FK, 8GI, (8HA), 8HG,
 8HM, 8HN, 8HR, 8HT, 8IC, 8IK, 8IN, 8JF, 8JS,
 8JT, 8JU, 8KM, 8KP, 8LO, (8LQ), 8ML, 8NL,
 8NZ, (8PQ), (8QJ), 8SF, 8SH, 8SP, 8XK, (8XU),
 (8ZA), (8ZE), 8ZL, 8ZR, 8ZV, 8ZY, (8ZZ), 9AAW,
 9AP, 9AN, 9BW, 9FM, (9FN), 9GS, (9HR), 9JN,
 9JT, 9LQ, 9MH, 9UU, 9XM, 9ZJ, 9ZN, NSF.

2AIH, TUCKAHOE, N. Y.—Dec. 1 to Jan. 18.
 1AS, 1AW, 1BBL, 1CK, 1CY, 1DY, 1GBC, 1GY,
 1HAA, 1IBD, 1JQ, 1OE, 1RAY, 1RL, 1VA, 1XK,
 1XF, 2ACC, 2ACM, 2ACK, 2AEF, 2AER, 2AFT,
 2AGA, 2AHL, 2AID, 2AIM, 2AKI, 2AKS,
 2ALL, 2ALP, (2AM), 2AMIL, 2AMQ, 2AMY, 2ANL,
 2ANQ, 2ANZ, 2AOG, 2APH, 2APJ, 2AQF, 2ASH,
 2AST, 2AUM, 2AVR, (2AXP), 2AYY, 2BB, 2BAF,
 2BBN, 2BAI, 2BEB, 2BK, 2BG, 2BM, 2CC,
 2CK, 2CJ, 2CL, 2CT, 2DA, 2DH, (2DK), (2DN),
 2FD, 2FO, 2GM, 2GR, 2HF, 2HJ, 2HN, 2HT, 2HZ,
 2IF, 2JJ, 2JN, 2JP, 2JU, 2JZ, 2KQ, 2LH, 2LJ,
 2MA, 2ME, 2MF, 2MP, 2NN, (2NT), 2OA, 2OC,
 2OM, 2OX, 2PR, 2PE, 2QE, 2QR, 2QK, 2QY, 2RB,
 2RK, 2RR, 2TF, 2UA, 2UE, 2UH, 2UL, 2VA, 2VZ,
 2WG, 2WL, 2WU, 2XK (phone), 2XX (phone),
 2YM, 2YY, 2ZE, 2ZD, 2ZL, 2ZM, 2ZN, 2ZR, 3ACS,
 3BG, 3BH, 3DH, 3DR, 3EN, 3GE, 3HB, 3HJ, 3NY,
 3OQ, 3RG, 3VA, 3ACF, 3ACU, 3AF, 3AKA, 3ALM,

3AM, 3AKJ, 3CG, 3DA, 3DC, 3DV, 3FI, 3FT, 3FZ,
 3GI, 3HA, 3HP, 3HY, 3JE, 3JQ, 3JU, 3KE, 3LF,
 3NL, 3NL, 3NM, 3OL, 3OM, 3QM, 3SP, 3TO, 3VJ,
 3VV, 3WU, 3WY, 3XE, 3XK, 3XU, 3ZA, 3ZE,
 3ZD, 3ZL, 3ZW, 3ZL, 3ZJ, 3LQ, 3ZN, 3BP, 3SF,
 3WW.

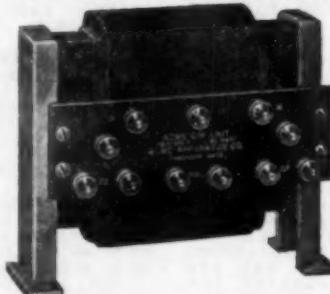
T. C. WHITE, JR., SEN, NORFOLK, VA.

Dec. 5th to Jan. 5th.

1AER, 1AW, 1BAB, 1BBL, 1CZ, 1EAV, 1EBW,
 1GBC, (1GBT), 1HAA, 1JAP, 1OE, 1RAY, 1TF,
 1TS, 2AA, (2AR), 2BB, 2BG, (2BK), (2BM),
 2CM, (2CT), 2CY, 2DA, (2DI), (2DN), (2EL),
 2GR, 2HG, (2HN), (2JJ), (2JU), (2JZ), (2ME),
 2OM, 2PL, 2QO, 2RB, (2RK), (2RM), 2RT, 2RV,
 2SU, 2SZ, (2TF), (2UC), 2UE, 2VA, 2XQ, (2ZD),
 2ZL, 2ZM, 3AA, (3AAE C.W.), 3AAN, 3AAS,
 3ABC, 3ACM, 3ACS, (3AHK), (3BG), (3BH),
 (3BZ), (3CC), (3CK), 3CL, (3CR), 3CT, (3DH),
 3DS, (3EH), 3EP, 3EV, 3GX, (3HG), (3HJ),
 3HW, 3HX, 3IW, 3JC, 3KM, (3OB), 3OU, 3PU,
 3QW, (3UC), (3XF), 3YX, (3ZA), 3ZZ, (NSF
 C.W. & tone), 4AG, 4AL, 4AN, 4BK, 4BQ, (4BY),
 4CJ, 4DA, 4EE, (4YB), 4XC, 5BC, (5DA), (5ER),
 5FV, (5XA), 5ZL, 5AAG, (8AAV), 8ACY, (8ADE),
 (8AE), 8AE, 8AEY, 8AF, 8AGZ, 8AB, 8AJW,
 8AKA, (8AKV), 8AKJ, 8AMQ, 8ARW, 8AS, 8AY,
 (8BO), (8BP), 8BV, 8CF, (8CP), (8CV), (8DC),
 8DJ, 8DP, 8DV, 8EC, 8EV, 8FI, (8FK), 8FL,
 8FM, 8FP, (8FT), 8GB, 8GW, 8HA, (8HG),
 8HM, 8HP, 8ID, 8IK, 8IL, 8IV, 8JF, 8JG, (8JJ),
 (8JS), 8KE, 8KM, 8KP, 8LE, (8LF), 8LQ, (8MH),
 8NZ, (8OJ), 8PT, 8QJ, 8QL, 8QM, (8RQ), (8SP),
 8TD, 8TN, 8TT, 8VJ, 8VK, (8WY), (8XH), 8XK,
 8XU, (8ZA), (8ZD), (8ZE), 8ZG, C.W., 8ZH,
 (8ZL), 8ZT, (8ZW spk, C.W. & tone), 8ZX,
 (8ZY), 8ZZ, (9AAC), 9AAF, 9AAG, 9AAW, 9AAV,
 (9ABI), (9ABL), (9AP), 9AV, 9AMN, 9AON,
 9BP, (9BW), (9CA), 9CF, 9CP, 9DV, 9EL, 9EQ,
 9ET, 9EZ, 9FT, 9GC, 9GN, 9GP, 9GS, 9GW, 9HG,
 9HM, 9HN, 9HW, 9JN, 9JT, (9LM), 9LQ, 9MB,
 9MC, (9MH), 9MP, 9OE, (9OX), 9PJ, 9PV,

C. W. APPARATUS

ACME



ACME

C.W. POWER TRANSFORMERS

ACME CW POWER TRANSFORMERS may be used with rectifying tubes to supply D.C. or may be used for high voltage A.C. on power tubes.

ACME FILAMENT HEATING TRANSFORMERS are essential for large power tubes.

ACME 1½ HENRY CHOKE COILS are electrical ironers.

ACME MODULATION TRANSFORMERS do not distort speech.

Made by the manufacturers of the famous

ACME SPARK TRANSFORMER

ACME APPARATUS CO. 26 WINDSOR STREET,
 CAMBRIDGE 39, MASS.
 TRANSFORMER AND RADIO ENGINEERS AND MANUFACTURERS

CO-OPERATIVE RADIO PURCHASING

When you buy collectively you pool the amateur purchasing power securing fast SERVICE and SAVING. 3000 other radio experimenters are availing themselves of our free membership. We need your assistance. Send us a trial order for anything of standard make advertised on this page or elsewhere in this magazine. These are the list prices of a few items we supply. Stamp brings details.

ACME APPARATUS

F-1 $\frac{1}{2}$ K.W. power transformer	\$30.00
H-1 1 K.W. power transformer	45.00
250 watt mounted	16.00
500 watt mounted	22.00
1000 watt mounted	33.00
250 watt semi-mounted	13.00
500 watt semi-mounted	18.00
1000 watt semi-mounted	28.00
200 watt C.W. mounted	20.00
200 watt C.W. unmounted	16.00
50 watt C.W. mounted	15.00
50 watt C.W. unmounted	12.00
Y-1 audion control complete	10.00
Y-2 audion amplifier	13.00
A-2 amplifier transformer	7.00
A-2 with new mounting	5.00
A-2 without supports, etc.	4.50
A-3 modulation transformer	7.00
A-3 without panels	5.00
M-2 .0035 condenser	32.00
M-2 .007 condenser	35.00

BRANDES RECEIVERS

Navy type 3200 ohms	\$14.00
Transatlantic 2800 ohms	10.00
Superior 2000 ohms	7.00
With Navy headband add	1.00

BAKELITE DILECTO

Approximate price of panel may be obtained by allowing 20 cubic inches per pound.
Cut to order, per pound.....\$3.00

DE FOREST COILS

DL-25 130-375 meters	\$1.65
DL-35 180-515 meters	1.70
DL-50 240-730 meters	1.75
DL-75 330-1030 meters	1.85
DL-100 450-1460 meters	1.95
DL-150 660-2200 meters	2.10
DL-200 930-2850 meters	2.20
DL-300 1550-4800 meters	2.45
DL-600 4000-12000 meters	3.25
DL-750 5000-15000 meters	3.30

DE FOREST

SW-100 Wavemeter	\$60.00
P-100 Audion control	68.50
P-200 2-step Amplifier	70.50
P-300 Detector-Amplifier	75.00
P-400 Audion Control	12.00
RS-100 Complete Receiver	30.00

ELECTROSE

Ball insulator	\$0.50
Small strain insulator	1.00
Large strain insulator	1.50

FEDERAL

Navy type 1 circuit jack	\$ 0.70
Navy type 2 circuit jack	1.00
Closed circuit jack	.85
Navy type plug	2.00
12 spring master switch	2.80
Army & Navy 3200 ohm headset	14.00
2200 ohm headset complete	12.50
Century high frequency buzzer	2.50

BATTERIES

That cannot be equalled.



Q-4 Marko 6 volt 60 ampere	\$17.10
Q-5 Marko 6 volt 80 ampere	21.60
Q-6 Marko 6 volt 80 ampere	23.60
Q-7 Marko 6 volt 40 ampere	14.60

"B" BATTERIES

22½ volt field type	\$1.25
22½ volt navy style	2.50
22½ volt Eveready, small	2.20
22½ volt Eveready, large	3.50

RHEOSTATS.

Adams-Morgan Paragon	\$1.75
Remler back mounting	1.75
General Radio back mounting	2.50
Bunnell PB surface mounting	1.25

MUTUAL PURCHASERS ASSOCIATION

2-4 Stone Street, New York, Dept. Q121.

Rotary Quenched Spark Gap
\$20.00 Postpaid



bakelite insulation. The smallest gap motor may be used, but is not supplied with gap. **GET YOURS SET UP AT ONCE, and INCREASE YOUR RADIATION AND RANGE!!**



**FILAMENT
RHEOSTAT**

For Back or Front of Panel Mounting.
6 ohms, 1½ amps.,
1½" dia.

\$1.75 Postpaid
Immediate Shipment.

Standard VT Socket
Improved Contact Type

\$1.00 Postpaid

Copper foil condenser
35c p.p.

44 V. VARIABLE "B" BATTERY \$3.60

Include postage on 4 lbs.
Complete in handy wooden case and adjustable phosphor bronze "jiffy" connectors. Better than block batteries—if one 4.4 V. unit weakens prematurely, it can be removed and replaced—thereby not impairing total voltage, which makes this the best battery value to be had at any price. Set of 10 Renewal Units, 44 volt, \$3.10 postpaid.

Young & McCombs Rotary Spark Gap Stock \$16

DE FOREST CV 500A VARIABLE CONDENSER \$3.75

AERIAL WIRE 1c. PER FOOT

7 strands No. 22 copper—tin plated to prevent oxidation. Maximum radiation and strength. Include postage on 15 lbs. per 1000 ft.



Honeycomb Coil Adaptor \$1.50 PER PAIR

Attach to binding post of any variable condenser, insert H-C coil, making a tuning unit. Two units make a loose coupler, a third makes a tickler coil, one makes a wavemeter.

GENERAL RADIO \$10 HOT WIRE AMMETER
New Price—\$7.75—(Type 127A)

Radio Equipment Co. 630 WASHINGTON ST., Boston, Mass.

HOT WIRE AMMETERS

We have on hand a large stock of Roller-Smith Type TAW Hot Wire Ammeters, with ranges of 0-1, 0-2.5, 0-5 amperes.

We are offering these at the remarkably low price of **\$6.50** each, postpaid.

Send 10c in stamps for our catalogue.

The Radio Electric Company

3807 Fifth Ave., S.,

Pittsburgh, Penna.



DUCK'S No. 14 Big 200-Page Wireless Catalog

Mailed for 12c in stamps or coin. The largest, most elaborate and most complete radio catalog published.

Everything in wireless worth while is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the Beacon Light to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere.

THE WILLIAM B. DUCK CO. 243-245 Superior St., Toledo, Ohio

RADISCO BETTER "B"

BATTERIES ARE BACK!

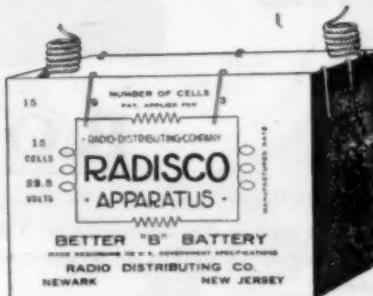
FOR THE PAST few months, manufacturing difficulties and inferior materials have made it advisable to discontinue the production of Radisco Better "B" Batteries.

In the meantime, however, our research work has developed new methods, better materials and more economical manufacturing principles.

Now, the NEW Radisco "B" Batteries are ready!—Powerful batteries with an operating life of 800 to 1200 hours at least—sturdy and well-built thruout—no batteries at the price are as good,—no batteries at any price are better. The Radisco dealer in your district has a complete stock of the NEW better "B" batteries. Get your supply from him!

No. 1. $3\frac{1}{4}$ "x $2\frac{1}{2}$ "x $2\frac{3}{4}$ " ... \$1.40
No. 2. $6\frac{1}{4}$ "x $4\frac{1}{2}$ "x $3\frac{1}{2}$ " ... 2.65

Both 15 cells, $22\frac{1}{2}$ volts. Larger size has exclusive Variable Voltage feature. Ask your dealer to explain it.



Special Notice to Radio Phone Experimenters

Do you know that Radisco Better "B" Batteries make a very reliable and satisfactory source of high voltage for Radio Phone and other CW work? A Radio Phone operating on Radisco "B" Batteries is exceptionally quiet and free from the disagreeable hum of a motor generator or the rectified 60 cycle tone.

THESE PROGRESSIVE DEALERS CARRY THE ENTIRE RADISCO LINE.

ALBANY, N. Y.
Shotton Radio Mfg. Co.
8 Market St.

ASHEVILLE, N. C.
Hi-Grade Wireless Instrument Co.

ATLANTIC CITY, N. J.
Paramount Radio Supply
518 N. Connecticut Ave.

BIENVILLE, QUEBEC, CAN.
Canadian Radio Mfg. Co.

BOSTON, MASS.
Atlantic Radio Co.,
88 Broad St.

BROOKLYN, N. Y.
Kelly & Phillips,
312 Flatbush Ave.

CHARLOTTE, N. C.
Smith Novotoy Electric

CHICAGO, ILL.
Chicago Radio Laboratories
1816 Carmen Ave.

EUREKA, ILL.
Klaus Radio Co.
Branch, Peoria, ILL

KANSAS CITY, MO.
McCreary Radio Supply
4th and Delaware Sta.

LOS ANGELES, CALIF.
The Wireless Shop
511 W. Washington St.

MONTREAL, P.Q. CANADA.
J. B. Miller
136 Vendome Ave. N.D.G.

NEW BRUNSWICK,
NEW JERSEY
Geo. N. DeLaplaine
306 George St. and
8th & Magnolia Sts.

NEW ORLEANS, LA.
Rose Radio Supply,
604 Gravier St.

NEWARK, N. J.
A. H. Corwin & Co.
4 West Park St.

NEWCASTLE, PENN.
Pennsylvania Wireless Mfg.
Co.
507 Florence Ave. "8HA"

OMAHA, NEBRASKA
O-B Radio Supply Co.
406 Brown Building

PHILADELPHIA, PENN.
Philadelphia School of Wireless Telegraphy
Broad and Cherry Sta.

PROVIDENCE, R. I.
Rhode Island Elec. Equip.
Co.
45 Washington St.

PITTSBURGH, PENN.
Radio Electric Co.,
3807 Fifth Ave.

PORTLAND, ME.
Atlantic Radio Co.,
15 Temple St.

SEATTLE, WASH.
Northwest Radio Service Co.
609 Fourth Ave.

SCRANTON, PENN.
Shotton Radio Mfg. Co.
P. O. Box 2
Branch, 8 Kingsbury St.
Jamestown, N. Y.

ST. LOUIS, MO.
The Benwood Co., Inc.
3424 Olive St.

TORONTO, ONT., CAN.
The Vimy Supply Co.
567 College St.

WICHITA, KAN.
The Cosradio Co.
1725 Fairmount Ave.

Radio Distributing Co.,

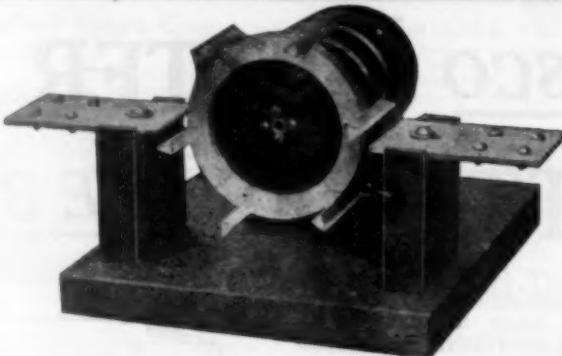
This mark



Newark, N. J.

your guarantee!

YOU
NEED
THIS



YOU
NEED
THIS

ROTARY

The WIMCO gap, noted for its clear, penetrating tone is gaining popularity rapidly. YOU will notice the difference in YOUR spark—it's in the gap. Made with 6 or 12 point rotor for resonant or non-resonant type transformers. Priced at \$50.00 F.O.B. Canton.

Get next to the WIMCO line—your name on our mailing list does it.

We have an attractive proposition for Dealers.

"8ZV" WIRELESS MANUFACTURING CO. "8ZV"
CANTON, OHIO



(PATENT APPLIED FOR)

No. 7650 VARIABLE—Price \$3.50
ESPECIALLY ADAPTABLE FOR
USE WITH GASEOUS VACUUM
TUBES. FINE VARIATION WITH-
OUT CURRENT LOSS.

AT YOUR DEALER.

RICHTER-SCHOTTLE CO., Mfgrs.
198 Roebling St., Brooklyn, N. Y.
PACENT ELECT. CO., Sole Eastern Agts.
150 Nassau St., N. Y. City.

BURGESS "B" BATTERIES

SEVERAL
SIZES
FOR
SPECIAL
WORK



SEND FOR CATALOGUE
**BURGESS BATTERY
COMPANY**

HARRIS TRUST BLDG.- CHICAGO, ILL.

TURNEY SPIDER-WEB INDUCTANCE COILS

Built at Radio Hill---

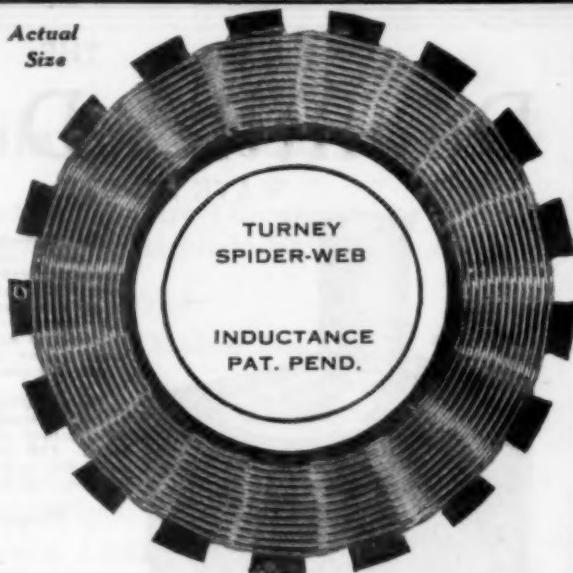


THE WINDING

showing angle at crossing. This style of winding has four distinct and exclusive advantages.

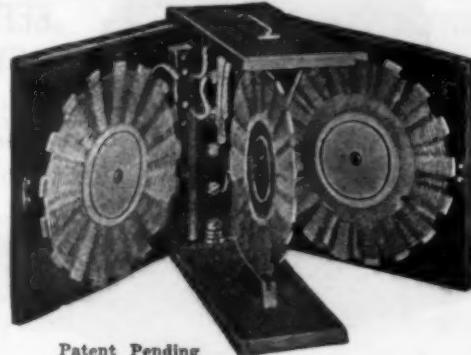
1. MORE INDUCTANCE—There is no magnetic leakage in coupling. The coils are flat, and the entire magnetic area is available.
2. LESS DISTRIBUTED CAPACITY. The wire runs parallel for a greater distance, and crosses itself less frequently than in any other coil known.
3. LOWER HIGH FREQUENCY RESISTANCE. There being no interior magnetic field, or air core, high frequency resistance is reduced to a minimum.
4. OCCUPIES LESS SPACE. The coils are so thin that three of them are less than $\frac{1}{4}$ inch in width.

Actual
Size



UP AT the foot of the Berkshires, amid inspiring surroundings, nestles Radio Hill. This ideal radio location is the scene of the development of the Turney Spider-web Inductance Coils. Here, far from any outside influence, Eugene T. Turney, Radio Engineer, the man who developed the Crystaloil Detector, has brought forth a sensational improvement in machine wound coils.

Below is shown the Turney complete receiving unit. It contains three Spider-Web Coils, the secondary and tickler being adjustable to the primary. The doors are capable of exceedingly fine adjustment. Six Binding posts allow for almost any type of circuit. With two condensers, .0005 and .001, this unit will respond to wave-lengths of 175 to 400 meters. The results will give you a new idea of radio efficiency.



Patent Pending

Illustration shows front of cabinet removed

Dimensions, $4\frac{1}{4} \times 5 \times 1\frac{1}{4}$

PRICE SIX DOLLARS COMPLETE

Order direct from this advertisement. Send check or money order for \$6.00 plus postage, and your Spider-Web Unit will come forward at once. OR write us for New Booklet, explaining the Spider-Web principle in detail.

EUGENE T. TURNEY LABORATORIES, Inc.
RADIO HILL, HOLMES, NEW YORK

Progressive dealers are invited to write for our interesting sales offer on Turney Complete Units.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

THE
Doolittle Decremeter
 WAVE LENGTH DECREMENT



(PATENT APPLIED FOR)

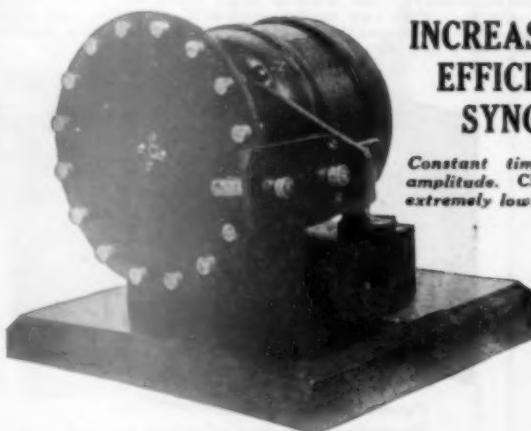
The Wavemeter is the Yard Stick of the Radio Art. In tuning up a Spark or C.W. set, and in countless laboratory experiments it is the ultimate source of reference. But the Wavemeter does not tell the whole story because it does not measure the Logarithmic Decrement, the factor which tells whether the energy radiated by your set is concentrated in a single sharp wave of great intensity or spread over a broad band of wave-lengths where it causes QRM and reduces your range.

The Doolittle Decremeter is both a superior Wavemeter and a Decremeter. The Wave-Length and Decrement can be obtained simultaneously, without complicated calculations. The range is 130-300 meters. An ideal instrument for radio Clubs as well as individuals. Immediate delivery can be made.

Price - - - \$25.00

SEND FOR BULLETIN 107R
 DESCRIBING THIS INSTRUMENT

F. M. DOOLITTLE CO.
 817 Chapel Street, New Haven, Conn.



INCREASE YOUR TRANSMITTING
 EFFICIENCY. Use a Ray-Di-Co
 SYNCHRONOUS SPARK GAP

Constant time interval between discharges of equal amplitude. Clear clean cut spark tone. Makes decrement extremely low. Keeps oscillations of open circuit out of closed circuit. Puts the current where it belongs, in the antenna. Motor follows every voltage variation obtaining the maximum condenser discharge. Total length of conductors in gap less than 3' permitting the use of a larger condenser. Adjustable stationary electrodes, large discharge surfaces, Bakelite-Dilecto Grade XX used throughout. Quiet running. Motor of single phase SYNCHRONOUS type 1/8 H. P., 110 volt, 60 cycle. Net wt. 35lbs. F.O.B. CHICAGO \$85.00.

RAY-DI-CO.,

2653D N. Clark Street,

Chicago

Specializing in the designing and construction of Radio Phones to your specifications.

SHRAMCO PANELS

Cut absolutely true, with polished edges.
 5"x5" $\frac{1}{8}$ " thick \$0.45 5"x10" $\frac{1}{8}$ " thick \$0.90
 6"x6" $\frac{1}{8}$ " thick .60 6"x12" $\frac{1}{8}$ " thick 1.20
 7"x7" $\frac{1}{8}$ " thick .80 7"x14" $\frac{1}{8}$ " thick 1.60
 Special $4\frac{1}{2}$ " by $\frac{1}{8}$ " thick for unit panels 60 cents
 Bulletin P describing the above panels sent on request

SHOTTON RADIO MANUFACTURING CO.
 8 Market Street, Albany, N.Y.

Best of Everything in
 Radio Apparatus and Parts.

Send stamp for Catalog "Q"

J. H. BUNNELL & CO.

32 Park Place, New York

"Shramco Oscillation-Transformer"

We offer this specially designed O-T of correct dimensions for amateur wave-lengths. Constructed of the highest grade material throughout.

SPECIFICATIONS

PRIMARY: 4 turns heavy 1" Copper Ribbon mounted on Formica strips.

SECONDARY: 8 turns heavy 1" Copper Ribbon mounted on Formica strips.

BASE AND UPRIGHTS: Hard wood, mahogany finish.
Both Coils movable. Fully guaranteed.

Cat. No. 60—SHRAMCO O-T, with 4 SHRAMCO Shielded O-T Clips.....	\$10.00
Cat. No. 60—SHRAMCO O-T, without clips.....	9.00
Cat. No. 61—SHRAMCO Shielded O-T Clip.....	.30

Shipping weight 10 lbs. Postage extra.



"Licensed Under Marsh Patent
No. 811859."

"Shramco Reo"

Panel type rheostat of the best material obtainable. Resistance element "NICHROME" mounted on electrical asbestos block. All metal parts brass. Spring phosphor bronze blade. Even regulation and smooth operation. Fully guaranteed. Base 3" dia. Overall height 2½". Shipping weight 1 lb. Postage extra.

Cat. No. 90—"SHRAMCO REO"—Resistance 6 ohms.....\$2.00 each

Special resistances made to order.

Send 5c in stamps for Catalog K.

Shotton Radio Manufacturing Company
P. O. Box 3, SCRANTON, PA.

USE THIS HEADSET IN THE RELAY TEST

The New High-Impedance Navy Type Headset Will Help You.

You will need a reliable and super-sensitive headset in the relay contest on February 22nd. With recent improvements in our Navy Type Headset we have succeeded in bringing out a headset with an A.C. resistance of 50,000 ohms at 800 cycles, thing never before accomplished in a commercial headset. It has a natural high pitch and will bring in thousand cycle notes clearly and distinctly and undamped waves can be read clearly and distinctly through static.



"Navy Type"—weight 9 oz. complete with head band and polarity indicating cord. Price \$14.00.

Navy Type Headsets are peculiarly adapted to vacuum tube reception. They are permanently adjusted at their highest point of efficiency and then carefully matched in tone. Because of their rugged construction they remain adjusted indefinitely.

Uninterrupted reception will be essential to your success on Feb. 22nd. The High-impedance Navy Type Headset can be depended upon to give you continuous service.

The most exacting comparative tests have convinced us that our High-Impedance Navy Type Headset is the most sensitive, most durable, and at the same time the lightest headset on the market, regardless of price. Our guarantee stands squarely behind every one of these claims.

You cannot afford to be without this new model on Feb. 22nd. Send us \$14 and we will mail you a Navy Type Headset. Try it for 10 days. If you are not absolutely satisfied with your purchase, return the headset and we will refund your money immediately.

C. BRANDES, Inc.

Room 821

32 Union Square, New York City
Also makers of
Trans-Atlantic Headsets,
25,000 Ohms, A.C. \$12.00
Superior Headsets, 2,000 Ohms, D.C. \$8.00
Send 5c for catalog "F".

Wireless Telephone TRANSMITTERS

need not be expensive



MAKE YOURS!

The Skinderviken Transmitter Button (thousands of which are being used on telephones all over the world) is the most sensitive current operator for sound waves. For use in radio telephony. I have developed a special model, possessing such excellent features as:

No packing of carbon granules. Angular position of diaphragm, no consideration. Maximum volume for minimum current. Buttons arranged in multiple for large current. Dead resistance and side tone practically eliminated. Clear, sharp articulation. Freedom of button to expand. Unusually large heat radiating surface.

THIS Transmitter Button has an unlimited field for experimenters in all branches of telephony—detectors—phonograph music transmission, etc. Illustrated circular free with each Button.

Local Battery, 2 to 7 volt. . \$1.00

Radio, 30 to 45 volt. \$1.00

Dealers are invited to write me for wholesale and jobbers price.

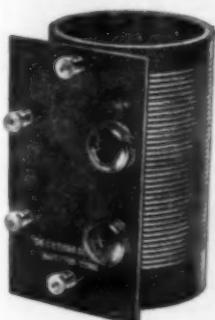
J. SKINDERVIKEN

Inventor and Manufacturer

154 W. Randolph St., Chicago, Ill.

Deaf-a-phone, price. \$15.00

Tuska "C. W." Equipment



Type 181

All Tuska Inductances are wound on grooved Bakelite tubes with Bakelite panels. Correctly made for efficient service.

TUSKA C. W.



Type 181 Unmounted

Mounted Inductance, Type 181.....	\$7.50
" " 182.....	10.00
" " 183.....	12.50
Unmounted, Inductance Type 181.....	5.00
" " 182.....	7.50
" " 183.....	10.00
Filter, Type 170 (750 volts).....	16.00
Meters, Type 190 (0-500 volts D.C.).....	17.25
" 191 (0-1500 volts D.C.).....	25.00
" 192 (0-5 amperes D.C.).....	7.80
" 193 (0-100 milliamperes).....	7.80
" 194 (0-10 amperes A.C.).....	7.80

Send 5 cents for our C.W. Booklet.

POWER TUBES

These Dealers Carry TUSKA "C.W." ACCESSORIES In Stock.

ATLANTIC RADIO COMPANY, Inc.,

88 Broad St., Boston, Mass.

GEO. S. SAUNDERS & COMPANY,

11 Devonshire St., Boston, Mass.

F. D. PITTS COMPANY,

12 Park Square, Boston, Mass.

LEO J. MEYBERG COMPANY,

428 Market St., San Francisco, Calif.

CAESAR KLAUS,

Eureka, Ill.

DETROIT ELECTRIC CO.,

56 Shelby St., Detroit, Mich.

PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY,

Parkway Bldg., Brook and Cherry Sts., Philadelphia, Pa.

DOUBLEDAY-HILL ELECTRIC COMPANY,

719 Liberty Ave., Pittsburgh, Pa.

A. H. CORWIN & COMPANY,

4 West Park St., Newark, N. J.

AMERICAN ELECTRO TECHNICAL APPLIANCE COMPANY,

235 Fulton St., New York, N. Y.

CONTINENTAL RADIO AND ELECTRIC CORP.,

6 Warren St., New York, N. Y.

MANHATTAN ELECTRICAL SUPPLY CO., Inc.

New York, Chicago, St. Louis

THE LINZE ELECTRIC CO.,

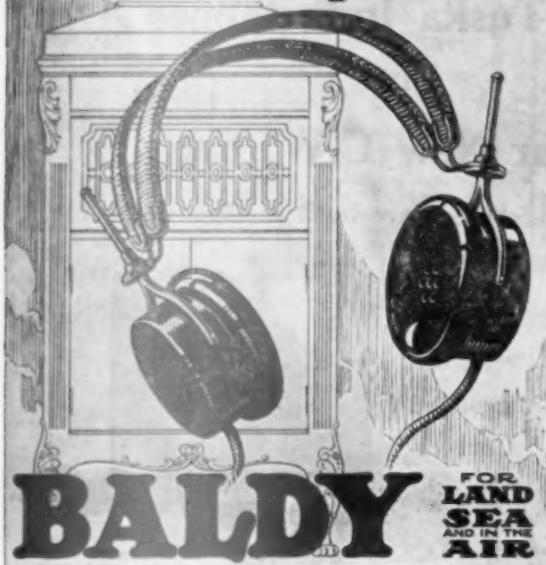
1129 Olive St., St. Louis, Mo.

THE C. D. TUSKA CO.,

HARTFORD, CONN.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Baldwin's reproduce like a phonograph



FOR
LAND
SEA
AND IN THE
AIR

MADE IN U.S.A.

REG. U.S. PAT. OFF.

TM

© 1923 JOHN FIRTH & CO., INC.

Send, direct or ask your dealer, for new Baldwin booklet.

It illustrates and describes fully.

JOHN FIRTH & CO., Inc.
18 Broadway - New York

Sole distributors of

Eldredge Measuring Instruments

Kolster Decrementer

U. S. Bureau of Standards Wavemeter

Navy Standard Leyden Jars

Brooks Adjustable Telephones

BALDY PHONES

Ra-Cond. Condensers

You Will Eventually
USE.

Hermetically
sealed, insuring
protection against
leakage.



SECURE

Ra-Cond

from your dealer or if he cannot supply you, send
direct, giving dealer's name.



Patented construc-
tion improving
appearance of
panel, eliminating
binding posts.

Ra-Cond will
fasten on rear of
panel to the grid
or secondary
binding post.

Made in two standard capacities:
Phone Condensers .003 Grid Condensers .0003

PRICE—75 CENTS POSTPAID IN U.S.

MANUFACTURED ONLY BY

RADIO EQUIPMENT COMPANY Philadelphia, Pa.

1525 N. Fawn Street,

A 15 Mile Radiophone Operating on "B" Batteries.

Out of a large stock of genuine double filament double life Audiotrons, we have carefully selected and tested a limited number of tubes which are especially fitted to be used in Mr. H. D. Selvage's 15 mile radiophone operating on "B" batteries. The circuit and details of construction of his set advertised elsewhere in this magazine has been thoroughly tried and proven by a large number of amateurs who are now talking over remarkable distances.

Results are positively guaranteed with our tubes in connection with the above set. We are offering you an excellent bargain by cutting the price of these genuine double filament specially selected Audiotrons from \$6 to \$5 each.

THE KEHLER RADIO LABORATORIES, 901 West 1st Street, Abilene, Kansas.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

The "Super" Benwood

Rotary Quenched Spark Gap

EFFICIENT AND PRACTICAL

SILENT IN OPERATION

A REAL "DX" GAP



A SOLID ONE PIECE BAKELITE CASTING

Highly Polished

Something entirely original in spark gap design,
at a price that you can afford to pay.

Stronger and lighter than aluminum. No metal being used in casting thus eliminating any and all electrical losses. Scientifically correct in every detail. Impossible for insulation to ever break down. Guaranteed for life.

Disc weighs only $\frac{1}{2}$ pound, yet it has the same sparking surface as the larger BENWOOD discs that are so well known thruout the country. Dimensions are, 6 inches in diameter, $\frac{3}{4}$ inch in width and the teeth or sparking surface are tapered down to less than $\frac{1}{8}$ inch in thickness. This gives the "quick break" that is theoretically proper and so highly desirable.

Smallest fractional H.P. motor will drive the gap with ease. Furnished complete with flexible coupling all ready to connect to any motor, regardless of size. Furnished with 8, 12 and 16 point rotors; merely specify type desired.

SPECIFICATIONS

Disc Housing is solid one piece BAKELITE casting. $\frac{3}{16}$ in. thickness thruout. Highly polished. Has seven brass bushings cast into outer rim to screw the cover to. Stationary electrodes are of heavy Bus bar copper and are tapered. Can be adjusted while gap is in operation. Heavy brass nuts are furnished for making connections. Cover is one piece casting and is so finely machined that the gap is practically airtight when cover is fastened in place.

Disc shaft is of best tool steel and turns in a bronze bearing $2\frac{1}{4}$ inches in length. Bearing is equipped with latest style grease cup.

DISC, is single casting, true to the hundredth part of an inch, material used is combination of pure aluminum and zinc blended to give the best quenching effect. Can be driven at speeds of 5000 R.P.M. and over with no appreciable vibration.

Overall dimensions of complete gap are, Height 8 in., width $7\frac{1}{2}$ in., thickness 3 in. Weight approximately 5 pounds.

PRICE AS SHOWN, \$25.00

The Benwood Company, Inc.

13th and Olive Streets,

ORDER FROM YOUR DEALER

St. Louis, Mo.

Have you watched our phenomenal growth? There's a reason! We have the goods—and plenty of them



This is "NUCLEUS" of your eventual phone transmitter.

Our bulletins, sent for 4¢ give full details and prices of this unit as well as separate parts. The BEST in VT transmitting and receiving specialties are also listed and described.

GENERAL RADIO No. 127 A.C. flush type Hot Wire Ammeters, \$7.75. In the following ranges—0-½, 0-½, 0-1, 0-2, 0-5 amperes.

SORALA TYPE J D'Arsonval D.C. 3½" flush type meters, \$7.00. In the following ranges—0-3 and 0-5 amps., 0-100, 0-300, and 0-500 millamps.

TYPE J 0-500 voltmeter....\$16.00

Sorala Service USE IT! Sorala Value GET IT!



New Products! We Have Them First
Approved Standard Products! We Have
Them Always

Grebe CR-3A Receiver.....	\$45.50
Paragon RA-10 Regenerative Tuner.....	55.00
Acme Modulation Transformer.....	4.50
Special Radio Microphone Transmitter With Adjustable Nickelized Bracket...	4.50
Threaded Bakelite Tube 3½" D. 6" Long	3.50
Transmitting Grid Condenser, .0005 Mfd.	1.00
Chelsea Balanced Panel Condensers, Now Equipped with 3½" Moulded Bakelite Dial and Knob, .0006 Mfd.....	4.25
.0011 Mfd.....	4.75
The above Condenser, with Our Type CSU 4½" D. Silver Plated Dial Indicator. Extra.....	1.75
See description in bulletin.	
Western Electric 1 MFD, 1000 Volt condenser.....	2.50

ALL THESE ITEMS SENT POSTPAID

General Radio Rheostat, 7 Ohms, 2 Amps....	\$2.50
Paragon Rheostat, 6 Ohms, 1½ Amps.....	1.75
Paragon V.T. Control Panel, Complete.....	6.00
General Radio Back Mounting Buzzer.....	2.00
S.P.S.T. Panel Mounting Toggle Switch.....	.40
12-12e Insulated Binding Posts (medium)....	1.25
12-18e Insulated Binding Posts (large)....	1.65
Adjustable H-C Coil Adapter.....	.75
Many New Uses—Plugs on Coto Coils, Back-of-Panel Coupling Coil Mountings, Loading Coil Mountings—Radio Frequency Amplifying Transformers, etc.	
Radiotron UV 200 detector tube.....	\$5.00
G-R 350 ohm "A" battery potentiometer....	4.00
C.W. Transformers, Chokes, Condensers, Etc.	

If About To Build A Phone Transmitter
FIRST—INVESTIGATE OUR— NUCLEUS

102 HEATH ST., SOMERVILLE, 45,
(3 Miles from Boston) MASS.

SOMERVILLE RADIO LABORATORY

Averaged 82% out
of a possible 90%

Ten graduates of the MASSACHUSETTS RADIO and TELEGRAPH SCHOOL during the *six weeks* examination period between November 1st and December 15th, 1920 established this record on their U. S. GOVERNMENT EXAMINATIONS for *first grade* Commercial Operator's license. Their average attendance was *5.1 MONTHS*.

The fact that a new United States Radio Inspector did the examining, using new and original questions unfamiliar to the graduates, speaks all the more favorably of our system and methods.

To produce *ten* graduates, who, within the short period averaging a little *over five months*, obtained such a high average, is the best way we know of to convince you of the merits of this school. *Results count.*

Names, addresses and full data sent on request to anyone.

Why not avail yourself of this service. It costs no more. *Send for free literature.*

MASSACHUSETTS RADIO AND TELEGRAPH SCHOOL

18 Boylston Street, Boston, Mass.

Tel Beach 7168

R. F. Trop

G. R. Entwistle

VACUUM TUBE CONTROL UNIT Type "AP"

Adaptable to any modern hook-up. Best appearing and highest type Detector Unit at the price in the market. \$10 parcel post prepaid in U.S.A. Illustrative Bulletin sent free on request.

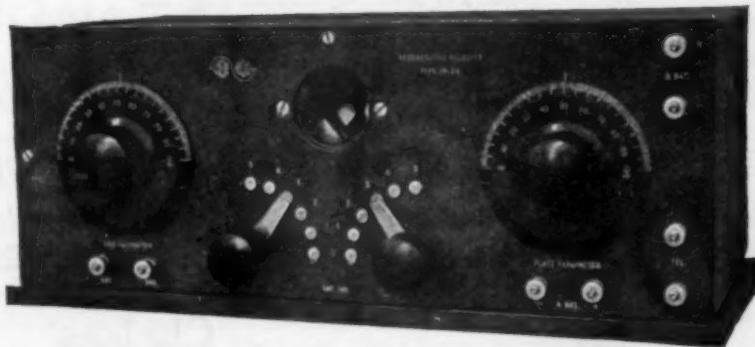
THE MIDWEST RADIO COMPANY, 3423 DURY AVE., CINCINNATI, OHIO.

Here's a Sure Winner—

For long distance work you can find nothing to beat the



Type CR-3A
Short-Wave
Regenerative Receiver
and
Vacuum Tube Unit



Compact, complete, dependable, with a wave-length range running up to 375 meters, it fills the need for a moderate-priced regenerative receiver. Built in every way up to the Grebe standard.

The CR-3A includes a variable antenna circuit, continuously variable grid and plate circuits, a specially designed coupling circuit and a standard vacuum-tube mounting with a grid condenser and leakage element. All binding posts are conveniently located on the front of the panel. The price \$45.50 is within the reach of all.

Be sure to ask your dealer about the CR-3A.

GREBE RADIO apparatus is licensed under
the original Armstrong and Marconi patents.

Central Radio Institute, Independence, Mo.
Continental Radio and Electric Corp., New York
Detroit Electrical Co., Detroit, Mich.
Doubleday-Hill Electric Co., Pittsburgh, Pa.
Electrical Specialty Co., Columbus, Ohio.
Holt Electric Utilities Co., Jacksonville, Fla.
Hurlburt-Still Electrical Co., Houston, Texas.
Kelly and Phillips, Brooklyn, N. Y.

Klaus Radio Company, Eureka, Ill.
Manhattan Electrical Supply Co., New York,
Chicago, St. Louis
Leo J. Meyberg Co., San Francisco, Cal.
Pacent Electric Co., Inc., New York City
F. D. Pitts Co., Inc., Boston, Mass.
Phila. School of Wireless Telegraphy, Phila., Pa.
Western Radio Electric Co., Los Angeles, Cal.

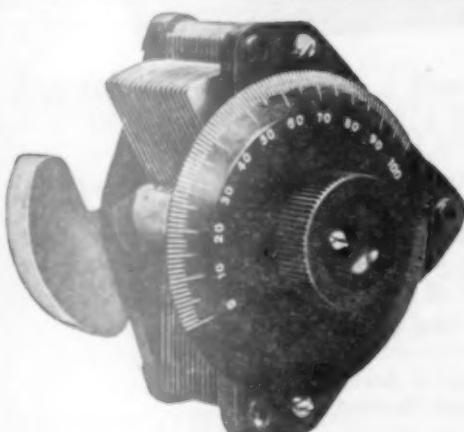
A. H. GREBE & CO., Inc.
74 Van Wyck Blvd., Richmond Hill, N.Y.

PERHAPS you have never realized that the advantages of our large stocks and low expense are available for your use, no matter where you live. Those who have been in our store have found *without exception*, a combination of practical helpfulness from our people, **and**, a complete assortment of the latest designs in radio engineering. As if this were not enough, we set a standard of prices that compares very favorably with any store in the city.

This service extends to our mail order sales. Just let us show you what it means to have people who thoroughly understand amateur radio attend to your orders.

Send 10c for our new 84 page catalogue, just out!
The assortments and prices will surprise you. And
an even greater surprise will be yours, when you see
how promptly and accurately we attend to your orders,
and how carefully your goods will be shipped.

American Electro Technical Appliance Company
Dept. B7, 235 Fulton Street New York City



No. 3 B. D.

Chelsea **Variable Condensers**

(Die Cast Type)

No. 1—.0011 m.f. mounted.....	\$5.00
No. 2—.0006 m.f. mounted.....	4.50
No. 3. B. D.—.0011 m.f. unmounted.....	4.75
No. 4. B. D.—.0006 m.f. unmounted.....	4.25
Bakelite dial only.....	.75

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

Unmounted types will fit any panel and are equipped with counter-weight.

Purchase from your dealer; if he does not carry it, send to us. Bulletin sent upon request.

Chelsea Radio Co., 15 Fifth St., Chelsea, Mass.

Manufacturers of Radio Apparatus and Moulder of Bakelite.

"EVERYTHING IN RADIO"

WESTERN RADIO ELECTRIC COMPANY

SEND FOR OUR LATEST

STOCK BULLETIN AND PRICE LIST

550 South Flower Street,

Los Angeles, Cal.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Finish Your Wireless Education

EITHER AT HOME BY MAIL OR AT OUR WASHINGTON SCHOOL
and

Let Us Train You
for a

First Grade (Government) Commercial License

* * *

AMATEURS

former Signal Corps and Navy men who have had some war training in Wireless—men and boys now operating their own private sets—should take advantage of our

The United States of America	
DEPARTMENT OF COMMERCE	
BUREAU OF NAVIGATION	
EXAMINATION	
RADIO OPERATOR, COMMERCIAL FIRST GRADE	
This shows my that George A. Gare has been examined and passed pursuant to the Radiotelegraphic Convention on	
(a) adjustment, operation, and care of apparatus.	
(b) transmitting and signal reading at speed of not less than 20 words a minute, Commercial Morse.	
(c) use and care of storage battery or other auxiliary.	
(d) knowledge of international regulations and that of Congress regarding radio communication.	
and is hereby licensed as required by law a Radio Operator Commercial First grade for one year. The candidate's practical knowledge of adjustments was tested on a Marconi set of apparatus. His knowledge of other systems is shown below.	
Operating knowledge of Fessenden system	
George A. Gare	Date of Survey granted
Radio Operator	Notary Public
Washington, D.C.	December 23, 1914
W. C. Roffield	E. T. Chamberlain
Secretary of Commerce	Commissioner of Navigation
U. S. Post Office	U. S. Post Office

SPECIAL THEORY COURSE

This course will enable you to pass your First Grade Commercial License examination, if your speed is now 20 words a minute. The Special Theory Course embodies all fundamental, practical, and theoretical work, (including both Code and Theory) necessary to pass the Government tests. We furnish instruments to complete code work, if students have none of their own. This course was planned by members of our faculty here in Washington who are especially familiar with the Government's latest requirements in Wireless. Men and boys holding amateur or second grade certificates CAN QUICKLY QUALIFY DURING THEIR SPARE TIME AT HOME for a first grade license, through this intensive course.

OPPORTUNITIES FOR FIRST GRADE LICENSED OPERATORS NEVER SO GREAT AS NOW

A recent inquiry made by this school at the Department of Commerce, showed there are actually less than 3,000 First Grade Licensed Operators in the United States, yet the present and near future demands of the rapidly growing Merchant Marine, Land Stations, Railroads, Steamship Lines, etc., will call for approximately 10,000 operators.

The National Radio Institute, well known as one of the chief sources for supplying operators in the past five years, is receiving calls every week to place men. This demand it cannot meet because of the shortage of operators. Never before has this Institute experienced such a shortage of men to fill the demands. The salaries offered are very attractive, ranging higher than ever before. One of our recent graduates is getting \$6,000 a year. If you are a First Grade Licensed man and want a good job now, write us immediately. We can place you, as we already have a long list of positions now open waiting to be filled.

If you are not a "First Grader" get busy at once and fill out the coupon below, which will bring you full information about these special opportunities, the low cost to get the necessary training, outline of the Course, and all about our School. Representatives wanted in every district to present this Course to wireless amateurs, radio operators and experimenters.

National Radio Institute
Dept. 446, Washington, D. C.

—FREE COUPON—FILL IN—SIGN AND MAIL TODAY—
NATIONAL RADIO INSTITUTE,
Department 446, Washington, D. C.

Gentlemen:

Without obligation to myself, please send me free of charge your illustrated booklet "Wireless the Opportunity of Today." Also quote me a special reduced rate and outline of Special Course I need to qualify for a First Grade Commercial License. My past experience in Wireless consists of

Name _____
Age _____ Address _____
City _____ State _____

"73" Puncture-Proof Condensers for C. W. Transmitters

73



Absolutely guaranteed against break-down on 1000 volts

Immediate delivery

2 MFD	- - -	\$2.50
5 MFD	- - -	5.00

The Radioelectric Shop

919 Huron Road,

Cleveland, Ohio



G-18

H. & D. VARIABLE CONDENSER

(New Style)

C-9 Knocked Down .001 m.f.	\$3.00
C-10 Assembled .001 m.f.	4.00

End plates are of bakelite, brass shaft running in special brass bearing, aluminum plates separated by accurately turned brass spacers. Furnished complete with Marconi knob and pointer, 180 degree brass scale, with screws to attach condenser to panel. Purchase from your dealer; if he does not carry it, send to us.

We have just developed a new line of high-grade parts, including condensers, grid leaks, switch arms, knobs, pointers, binding posts, scales, contacts, etc. Write for bulletin on this apparatus. We are sure it will interest you.

HARRISON & DUDLEY,

Elmira, N. Y.

SPEAKING OF SUPER-QUALITY

Super-Range Short Wave Regenerative Receiver & Amplifigon Cabinet.

Price Complete, \$170.00

They try to tie it, but can't beat it.

Short Wave Receiver, \$65.00—Amplifigon, \$105.00

Audion Detector, \$20.00—One Stage Amplifier, \$33.50

Two Stage Amplifier, \$65.00—Lattice Wound Variometers, \$7.50

Apparatus Designed by Radio Engineers.

Write for particulars of this new apparatus to

ARTHUR HAAKE,

West Norwood, N. J.

RADIO APPARATUS

*Distributors of Reliable Radio Apparatus to Schools,
Colleges and Experimenters All Over the World!*

"PITTSCO"

The Sign of Superior
Service!

All We Ask is a Trial!



"REMEMBER"

We Carry an Immense
Stock! Send Us Your
Orders Today!

AMPLIFYING TRANSFORMERS.	
No. 166A Gen. Radio, unmounted.....	\$4.50
No. 166A Gen. Radio mounted.....	7.00
No. Z7392 Clapp-Eastham unmounted.....	4.00
No. Z7392A Clapp-Eastham mounted.....	6.50

ANTENNA CHANGE-OVER SWITCHES.	
No. P-1 Kilbourne and Clark, bakelite base, good value.....	\$ 5.80
No. Y-658 Clapp-Eastham 1 K.W. Size.....	12.50

AUDION CONTROL PANELS.	
No. P-400 DeForest without cabinet.....	\$10.90
No. P-401 DeForest with cabinet.....	13.25
No. P-500 DeForest with cabinet and 45 volts "B" battery.....	24.00

"B" BATTERIES	
No. 7623 Standard 22.5 V. Small.....	\$1.50
No. 7625 Standard 22.5 V. Large.....	2.65
No. 7650 Standard 22.5 V. Variable.....	3.50

COILS (Litz)	
LL-300 Mounted.....	\$2.10
LL-750 Mounted.....	2.80
LL-1000 Mounted.....	3.00

COIL MOUNTINGS	
No. LC-101 with gears and base.....	\$12.00
No. LC-201 with gears and base and primary switch.....	13.00
No. LC-100 with gears but no base.....	9.00

DE FOREST PANEL UNITS.	
No. US-100 Primary switch.....	\$2.40
No. US-200 Anti-cap. switch.....	3.95
No. US-400 two point tickler switch.....	1.90
No. U-300 "A" Bat. switch and Tel. Binding Posts.....	2.00

DE FOREST VERNIER CONDENSERS.	
No. CV-1010 .001 without vernier in glass case.....	\$17.50
No. CV-1013 .001 with vernier in glass case.....	19.50
No. CV-1500 .0015 unmounted without vernier attachment.....	13.95
No. CV-1503 .0015 unmounted with vernier attachment.....	15.60
No. CV-1510 .0015 without vernier in glass case.....	18.95
No. CV-1513 .0015 with vernier in glass case.....	20.60

NOTE—Any of the above condensers are admirably adapted for radio telephone work.

CONDENSERS (Variable).	
No. F-800 .0006 Clapp-Eastham Bal.....	\$7.50
No. F-800A .001 Clapp-Eastham Bal.....	9.50
No. F-800B .0015 Clapp-Eastham Bal.....	11.50

CONDENSERS (Low voltage)	
No. ES-355 1 MF 500 Volts.....	\$1.25
No. ES-356 2 MF 500 Volts.....	1.25
No. 21AA Western Elec. 1000 Volts A.C.....	2.50

IMPORTANT! Every article listed sent to any part of the United States, postage prepaid or express prepaid. We want your business!

"Catalog No. 22 (Just out) sent upon receipt of ten cents in stamps".

LET "PITTSCO" PRODUCTS, SUPER-SERVICE AND
PROMPT DELIVERY SOLVE YOUR RADIO PROBLEMS!

F. D. PITTS CO., INC.
12 PARK SQUARE, Dept. A, BOSTON 11, MASS. U. S. A.

Increase Your Receiving Range Greatly



BY INSTALLING AN EV-RA-LAB
TYPE A-2 AUDIO FREQUENCY
AMPLIFIER.

A neat and highly efficient instrument with its price within the reach of all. The Amplifying coils have the correct impedance value for the modern vacuum tubes.

**Amplification Over 100 Times
Price Without Cabinet or Tubes, \$35.00**

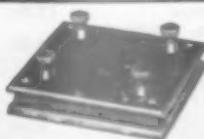
If you instal one of these Amplifiers you will have a station which you can be proud of.

Send for Bulletins describing our Detector and Amplifier Units

EVANSVILLE RADIO LABORATORY

1103 S. Third Street,

Evansville, Indiana



SOMETHING NEW. 200 METER RESONANCE TUNER

Designed and made similar to the new resonance coils recently explained by the U. S. Signal Corps. Range wave lengths 175 to 300 M. with ordinary amateur aerial and a 41 or 21 plate condenser in series with ground lead. Higher wave lengths obtained by using the condenser across the aerial and ground.

WIRELESS PHONE MUSIC clearly read and amateur signals galore. It is conductively wound with pure copper tape for the high frequency currents of the low wave lengths and is very efficient.

A SPLIT PHASE COIL inside and outside diameter is another new departure in Wireless work. Tuner weighs 2 lbs. Hardwood base polished Formica top with four binding posts. Wiring diagram on base. FOOL PROOF—INDESTRUCTIBLE—SELECTIVE—and works only with an audion. (Can be used in a panel or on table.) Quantity production permits us to offer this WONDER TUNER at \$6 add Parcel post.

10c brings a real catalog of 16 pages from

T R E S C O

Davenport, Iowa

* WHY YOU SHOULD DEMAND R-T-S GRID CONDENSERS *

R-T-S GRID CONDENSERS are the best Grid Condensers obtainable. They are not to be compared with any other makes on the market, as the design and quality surpasses all other Grid Condensers, the same as the Aeroplane of today far exceeds the horse for speed.

WIDE SURFACE COPPER FOIL, in conjunction with lead foil is used EXCLUSIVELY by us in the construction of R-T-S Grid Condensers.

R-T-S GRID CONDENSERS, mounted on strong insulating material, with an accurate capacity of .0005 M.F., together with the astounding low price puts these condensers in a class far above others.

PRICE \$0.30 EACH—POSTAGE 3c.

Fixed Condensers .0013—each 35c—postage 3c.

WE GUARANTEE THE R-T-S GRID CONDENSER, to give satisfactory service, or money refunded. If for any reason these condensers prove defective in 5 YEARS, we will replace same FREE of CHARGE.

REMEMBER—R-T-S Instruments and Parts, Backed by a Reputation, which Guarantees Quality and Satisfaction.

RADIO TESTING STATION, :::: Binghamton, N. Y.



TEL.
BACK BAY
5964

899 BOYLSTON ST.
BOSTON, MASS.

RADIO
INSTITUTE



DO YOU KNOW ? ? ?

That the EASTERN RADIO INSTITUTE offers more undeniable advantages to those interested in studying Commercial Radio than any other school in New England, if not in the country?

DO YOU KNOW that the EASTERN RADIO INSTITUTE is the OLDEST, LARGEST and BEST EQUIPPED radio and telegraph school in New England?

To make this unmistakably clear we can give the following facts:—

The EASTERN RADIO INSTITUTE was founded in 1913 and is now OVER SIX YEARS OLDER than ANY OTHER Radio and Telegraph school in New England! All schools starting before us are NO LONGER IN EXISTENCE !!! WE ARE THE PIONEER SCHOOL.

The EASTERN RADIO INSTITUTE actually has HUNDREDS of earnest and intelligent students now in attendance. We have given instruction at this date to over 4000 different students and have actually enrolled, graduated and placed more Commercial operators than ALL OTHER SCHOOLS IN NEW ENGLAND COMBINED!

The EASTERN RADIO INSTITUTE is equipped with THOUSANDS and THOUSANDS of dollars worth of splendid panel spark sets, Federal Arc apparatus, panel receiving sets, storage battery equipment etc. !

DO YOU KNOW that the EASTERN RADIO INSTITUTE has ALWAYS placed every graduate in a good position, kept them employed and can actually GUARANTEE these positions?

DO YOU KNOW that our graduates may be found all over the world as Chief Operators, Teachers in other Radio Schools, Chief Radio Inspectors, Engineers, Directors of Corporations, Superintendents, etc.?

DO YOU KNOW that we are the ONLY school in New England giving instruction upon actual Federal arc apparatus?

DO YOU KNOW that our systematically planned and thoroughly executed course of practical instruction positively brings RESULTS?—Your Commercial first grade license.

Certainly these advantages must be apparent to you. Besides it costs no more to take our course thus availing yourself of our YEARS of RESULTS and SUCCESS. SUCCESSFUL graduates of the EASTERN RADIO INSTITUTE are found all over the world! Why not be one?

Day and Evening classes. Start any Monday.

Our latest, illustrated prospectus is free. If you cannot visit the Institute send for one. If there is any further information or assistance our organization can give you please command me!

Sincerely Yours, F. D. PITTS, Director.

ANNOUNCEMENT

ANNOUNCEMENT

THE KARLOWA RADIO CORP.
STOCK ROOMS, 5TH FLOOR BEST BUILDING
MAIN OFFICE, 611 BEST BLDG., ROCK ISLAND, ILL.

HAS PURCHASED THE ENTIRE RADIO BUSINESS OF
THE YOUNG & MC COMBS CO. OF ROCK ISLAND, ILL.

The new organization solicits your orders as they have heretofore been placed with the old company. A new catalog is in preparation, and until it is issued, you are requested to make your selections from Catalog B and Supplements of the former Young & McCombs Co. Immediate deliveries are guaranteed on all items.

Address all orders and correspondence to

THE KARLOWA RADIO CORPORATION

611 Best Building,

Rock Island, Ill.

ATTENTION, YOU RADIO MEN

Our retail department is ready to serve you—We are equipped to handle all orders promptly due to the fact that we maintain a force which is ready to give you that service which you are looking for.

If you live in Cuba your order will receive the same personal attention which it would if you walked into our store and took your purchase out with you. That's our way no matter where you live.

We can supply you with practically every make of radio apparatus which is of the dependable grade. We have everything from a ground clamp to an antenna insulator ready to ship to you. Just state your needs and we will care for them.

Our bulletin 100 will be ready October 1st. You had better drop a card for your copy now so that you will be sure to get one.

OUR MOTTO IS "QUALITY FIRST, THEN SERVICE"

Manufacturers and Distributors of Radio Telephone & Telegraph Apparatus.

THE NORTHERN RADIO LABORATORY
111 MAIN STREET, CLYDE, OHIO



SHOULD A "B" BATTERY HAVE TAPS?

Some of the modern tubes on the market require that the B Battery be variable in voltage by means of taps, potentiometer or otherwise. We believe that our method of having a tapped B battery connected to a number of jacks on the panel itself makes a convenient and attractive means of such variation.

Our prices beginning the first of February are as follows:
Type 1D New "ERA" VT Control Panel with High Voltage variation and PARAGON filament rheostat..... \$10.00 P.P.
Type 2D New "ERA" VT Control Panel without High voltage variation (Paragon filament rheostat)..... 9.50 P.P.
Type 1A New "ERA" One Step Amplifier without High voltage variation (Paragon filament rheostat)..... 15.00 P.P.
Cabinet for either control panel or amplifier..... 3.00 P.P.

All types supplied without tubes or batteries.
We can also supply grid condensers, grid leaks, resistances for amplifiers, bakelite sockets and tapped B batteries.
Send for descriptive circular.

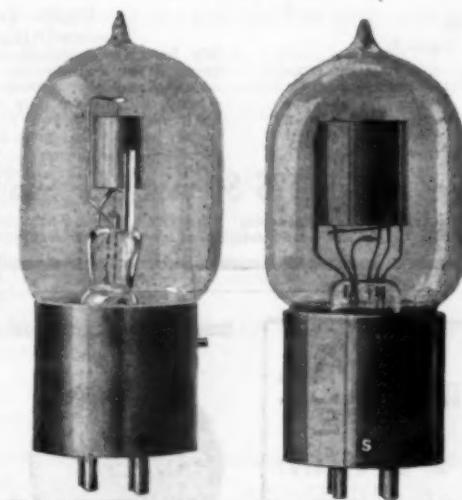
The Eastern Radio Company, 939 D St., N.W. Washington, D.C.

remember-

The A-P Electron Relay and the A-P VT Amplifier-Oscillator constitute the one proven vacuum tube combination on the market to-day. Perfected in May 1920, this combination has *made good in actual use*. AND A-P tubes are the only tubes equipped with the SHAW *bakelite* base—the base that prevents surface leakage, the base that prevents the tube from absorbing atmospheric moisture, the base adopted by the U.S. Navy Department—an exclusive, patented feature of A-P tubes.

When you want an efficient amplifier in which none of the amplifier qualities are sacrificed to make it also a detector, use the A-P VT Amplifier-Oscillator. When you want an efficient detector in which none of the detector qualities are sacrificed to make it also an amplifier, use the A-P Electron Relay.

USE
A-P
tubes for
efficiency



The A-P Electron Relay is the most sensitive spark detector known to the radio art. It is a soft tube. It contains the right quantity of gas and, equally important, the right kind of gas. The electrodes are correctly designed. On the market since May, 1920 it has made good in actual use and proven these facts in the test of time.

USE
A-P
tubes for
efficiency

The A-P VT Amplifier-Oscillator, equipped with the SHAW standard four-prong (bakelite) base. Price \$7 and worth it. At dealers.

The A-P Electron Relay, equipped with the SHAW standard four-prong (bakelite) base. Price \$6 and worth it. Order from your dealer.

A combination of two or more A-P VT tubes as amplifiers with an A-P Electron Relay as the initial detector or oscillator is the ideal receiving combination for long distance amateur or long wave reception. Only with such a combination can full efficiency be attained.

For sure results, for better results use A-P tubes and only A-P tubes. Licensed by the Radio Corporation of America under DeForest Audion and Fleming patents for amateur and experimental use in radio communication. Equipped with the SHAW standard four-prong (bakelite) base.

ATLANTIC RADIO SUPPLIES CO.
8 KIRK PLACE - NEWARK-NEW JERSEY **PACIFIC RADIO SUPPLIES CO.**
638 MISSION ST.-SAN FRANCISCO-CAL.
Distributors for the Moorhead Laboratories, Inc.

Makes audions function properly

The grid condenser is the most important part of an audion set. The grid of an audion is its control element. And the *Pen Brand Grid Condenser* makes the audion grid function properly.

Firm, strong, rigid and substantial. 3" long, 5.8" wide, 3.4" deep, properly insulated and carefully made of best materials — formica, heavy copper foil and India mica. This construction will not absorb moisture.



Every one guaranteed to work and serve satisfactorily or money refunded. No matter what audion set you are using, *Pen Brand Grid Condenser* will increase its efficiency. Order from your dealer or write direct.

Pen Brand Grid Condenser --- \$1.00 postpaid anywhere in America
Pen Brand Phone Condenser --- \$1.25 postpaid anywhere in America
(Same construction as Grid Condenser except that Phone Condenser has a capacity of .001 mfd.)

Pen Brand Series-Parallel Switch

For changing the position of the primary condenser from series to parallel. This switch is essential to receiving sets using honeycomb coils. Can also be used in many other places to advantage. Knob is large with nickel-plated blades, shafts, and screws. Price \$1.25.

Radio Telephone

Transmitting Apparatus

We have a complete line of radio telephone transmitting apparatus and can supply you quickly and economically from our large stock. Gladly, too, do we help radio amateurs assemble their sets. Are you having trouble? Do you want help? Do you need apparatus? Write us—to-day.

Radio Telephone Shop, 175 Steuart St., San Francisco, Cal.

Manufacturers of Pen Brand Apparatus. Correspondence invited from dealers and distributors. We want representation in your district. Write us.

A ACE C.W. Equipment ACE E

788 miles on nine-tenths of an ampere!

In test of our C.W. Transmitter, signals were copied at this distance. (Details on request) Complete transmitter mounted on grained formica panel 10 x 14 x 3/8, including motor generator, 4 A-P transmitting tubes, filter device, filament heating transformer, microphone, antenna current ammeter, plate current milliammeter and all necessary controls, etc.—\$395.00, f.o.b. Cincinnati. Complete transmitter less motor-generator—\$285.00.

Equipment so designed that either voice, buzzer, modulated C.W. or straight C.W. transmission may be used by throwing single switch on panel. Construction of apparatus and material employed is of usual "ACE" quality.

"You may pay more, but you can't buy better."

The Precision Equipment Co., Inc.
2437 Gilbert Ave.
CINCINNATI, Dept. D., OHIO



*The New
Cunningham
Audiotron*

FREE TUBES

Every up-to-date radio amateur requires two important items to keep abreast of the times. One of these items is a Vacuum Tube—the other is a subscription to—

PACIFIC RADIO NEWS

Why not get both at the price of one?

Get four of your radio friends to subscribe for one year or send us your own subscription for four years and we will immediately send you the New Cunningham Audiotron or the A.P. V.T. Amplifier-Oscillator or the A.P. Detector Tube. Subscription rate, \$2.00 per year. Add 25c for postage. You save from five to seven dollars on this offer. All tubes are new and genuine, and fully guaranteed by the manufacturer. Send us your subscription today!

PACIFIC RADIO PUBLISHING CO.
50 Main St., San Francisco.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

20% REDUCTIONS. SURPLUS STOCK SALE

During the past few months we have become over-stocked with apparatus intended for the Christmas season. During the few weeks just passed we have sold a great amount of this material but our enormous stock must still be greatly reduced. We must realize money out of this surplus immediately and are therefore offering a uniform reduction on the following equipment of DeForest manufacture.

These items take in the well known DeForest condensers than which there are none other higher in quality and efficiency.

It is needless to say that the rush for this apparatus will be very great and we therefore are adopting a policy of "First Come, First Serve". Send your order at once. Delay may lose you great bargains.

DE FOREST VERNIER CONDENSERS

	List Price	Our Price		List Price	Our Price
CV-1000	\$14.80	\$11.85		CV-1010	\$21.00
CV-1020	20.75	16.56		CV-1510	21.80
CV-1023	21.80	17.44		CV-1530	24.00
CV-1523	24.50	19.60		CV-1030	22.00
CV-1520	22.20	17.76		CV-1003	17.10
CV-1500	16.80	13.44			

Shipping weight on all condensers 6 lbs.

DE FOREST CV-500 PANEL MOUNTING CONDENSERS

	List Price	Our Price
Type CV-500—25 plate .0005 M.F.—shipping weight 4 lbs.	\$6.25	\$5.00
Type UCV-500—25 plate .0005 M.F.—shipping weight 4 lbs. mounted on unit panel.	7.75	6.20
Type U-100 same as UCV-500 with Grid Leak mounted on panel.	8.50	6.80

We can offer immediate shipment on the following articles:

Type UV-200 Radiotron—shipping weight 1 lb.	\$5.00
Type UV-201 Radiotron—shipping weight 1 lb.	6.50
Moorhead A-P Electron Relay—shipping weight 1 lb.	6.00
Moorhead A-P Amplifier-Oscillator—shipping weight 1 lb.	7.00
Moorhead A-P Transmitting bulb—shipping weight 1 lb.	7.50
Standard small size B battery—shipping weight 2 lbs.	1.40
Standard large size B battery—shipping weight 5 lbs.	2.40

Send 15c for our large illustrated catalogue. This amount will be refunded on your first order for \$1.50 or over. High printing costs make free distribution impossible.

Electrical Specialty Company

Dept. S
48-50 S. Front St.
COLUMBUS, OHIO

Dept. S
20 N. 9th St.
PHILADELPHIA, PA.

CONSOLIDATION ANNOUNCEMENT

This is to announce that the MILTON SPECIALTY COMPANY OF COLUMBUS, OHIO is now affiliated with the ELECTRICAL SPECIALTY COMPANY OF THE SAME CITY and will henceforth trade under that name. The policy of the company which has always stood for high quality and service, will remain the same.

Under the Consolidation agreement this company will continue to handle the Radio Operators' emblems which have proven themselves tremendously popular in the short time that they have been on the market. In addition the company is prepared to supply Radio Clubs with individual pins for their organizations. At the present time plans are under



way to publish a catalogue showing popular designs but in the meanwhile we solicit inquiries as to your wants. When writing, a rough sketch of the pin desired would help the company's artist to present in concrete form an idea of what any pin would look like when made. Quotations gladly made under these conditions.

Above cut represents our popular 14 karat gold-plated coat emblem beautifully finished with a blue-enamored edge. A truly artistic button that you will be glad to wear.

Prices (Postpaid)

Emblem coat button.....	\$1.00
14 Kt. Gold-Filled ring—20 year guarantee.....	3.75
14 Kt. solid gold ring.....	9.50

Dealers, jobbers and radio clubs write for our proposition.

ELECTRICAL SPECIALTY COMPANY
TWO OFFICES FOR YOUR CONVENIENCE

Dept. Q
48-50 So. Front St.
COLUMBUS, OHIO

Dept. Q
20 N. Ninth St.
PHILADELPHIA, PA.



Announcement in Re: WICONY RADIO APPARATUS

Having acquired new and greatly enlarged factory facilities in order to take care of the extraordinary demands being made on us by the government, commercial and foreign requirements, we beg to announce the consummation of an arrangement with

THE PACENT ELECTRIC COMPANY, Inc.

MR. LOUIS GERARD PACENT, Pres.

150 Nassau St., New York City

whereby that Company, and Mr. Pacent will act as exclusive sales agents for Wicony Products to the experimenter, amateur, educational and research trade.

Thus there is associated the most progressive manufacturers of High-Grade Radio Products and the most progressive selling agency in the country, through which their product will be distributed.

The result will be more and better service, as well as more and better apparatus for all.

WIRELESS IMPROVEMENT COMPANY

Radio Engineers, Manufacturers and Distributors.

47 West Street,

New York, N. Y.



7 Y G
330 meters—500—2 K.W.

Learn Radio

A vocation with wonderful opportunity to Travel and Study.

Foreign Trade—Marine Engineering—Navigation

We offer thorough training in
Radio Operating and Engineering,
damped and undamped systems.

Complete Laboratory and Station Equipment.

OREGON INSTITUTE OF TECHNOLOGY
Portland, Oregon—Division Q.



Type 182

AIR CONDENSER

Save Your Received Energy

Why do some stations receive consistently from long distances? Because they utilize the maximum amount of the received energy. They do not allow it to leak away in poor condensers. Our Type 182 condenser is built to give real service and enables your station to get the maximum of results. The plates are cut out of round so as to give a nearly uniform wavelength variation. They are substantial and do not short circuit.

Made in .0007 and .001 M.F. sizes. Furnished both mounted and unmounted with prices ranging from \$8.50 to \$13.50.

Described and listed in Bulletin 904Q.

GENERAL RADIO CO.

11 Windsor Street
CAMBRIDGE 39, MASSACHUSETTS

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Have You?

Ever wanted to construct radio instruments and were unable to secure reliable drawings? **YOU HAVE!**

Ever needed the best "hook-up" for your receiver and were unable to locate one? **YOU HAVE!**

Ever had trouble with the operation of your apparatus and wanted to consult someone that knew? **YOU HAVE!**

Ever hesitated before buying apparatus, not knowing which was the best for you? **YOU HAVE!**

You can now have competent assistance on any experimental work, can have blueprints of any instruments you wish to construct and it will be the best known design today.

You can have wiring diagrams for any combination of instruments and it will give you the best results obtainable.

Associated with our service, are a number of Commercial Radio Engineers of many years experience and you can have the benefit of their knowledge on any subject and know that you will receive the right solution.

Charges for this service are small, 25 cents up, dependent on work involved and number of blueprints to be supplied.

Write us now, what you wish to construct, what you wish to know and what is holding back your progress. We will immediately advise the cost.

Money Immediately Refunded To Anyone Not Completely Satisfied.

Experimenters Information Service

45 Pinehurst Avenue,

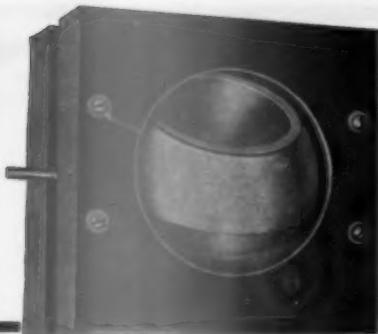
Suite 51

New York City

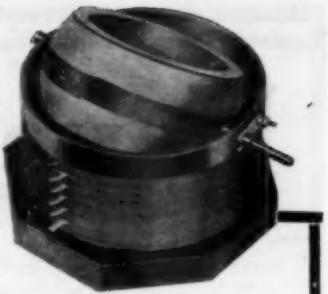
CHARLES R. LEUTZ, Director, Formerly Designing Radio Engineer, Marconi Wireless Telegraph Co. and Liberty Electric Division of the Mallory Industries, Inc.

EUROPEAN BRANCH: 17 GREEN STREET, LONDON W.C.2, ENGLAND

"CESCO"



—*is the trade name given the low-priced, high-quality, guaranteed apparatus distributed exclusively by the California Electric Supply Co. of San Francisco. Buy "CESCO," save money, and be satisfied. If your dealer cannot supply you with the following—write direct.*



Note the low price—

V-100—CESCO VARIO-METER for the grid and plate circuits of short wave regenerative receivers. Correctly designed and carefully constructed of thoroughly seasoned hard maple—cannot and will not warp, shrink, or crack as soft wood variometers frequently do. All windings bound and insulated with CESCO special impregnating compound. Price, postpaid—\$8.50. Order number V-100.

DEALERS—
WRITE US.

CALIFORNIA ELECTRIC SUPPLY CO.
643 Mission Street

C-100—CESCO VARIO-COUPLER for use in \$6.75

connection with CESCO variometer. The secondary is ball type. Primary consists of a threaded tube 4 inches in diameter and 2 inches high made of unshrinkable composition and wound with large-gauge bare copper wire. CESCO VARIOCOUPLER complete, mounted on hardwood base for panel mounting, price—\$6.75. Order number C-100.

DEALERS—
WRITE US.

Any other supplies you need now? We have them. And your inquiries are welcome as your orders. We supply every want the way you want it supplied.

"Radio Supplies That R Right"

MAGNET WIRE

We are prepared to furnish best grade magnet wire on $\frac{1}{4}$ and $\frac{1}{2}$ lb. spools at the following revised prices effective January 15th.

PRICE PER $\frac{1}{4}$ LB. SPOOL

Size B & S Ga.	Single Cotton	Double Cotton	Single Silk	Enameled
No. 22	\$0.56	\$0.68	\$0.62	\$0.45
No. 24	.60	.77	.67	.47
No. 26	.65	.88	.71	.49
No. 28	.75	1.10	.85	.52
No. 30	.85	1.24	.97	.53
No. 32			1.15	.55
No. 34			1.52	.59
No. 36			1.77	.69

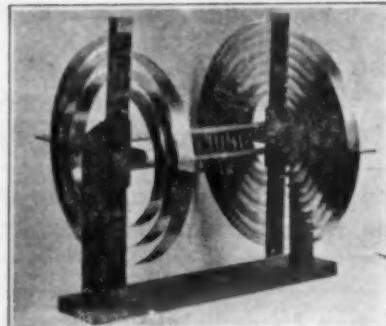
Price of $\frac{1}{2}$ lb. spools double above list.

All prices are net and include cost of spool and Insured Parcel Post charges to any Post Office address in the United States.

Send for circular showing prices on other sizes, quantities and insulations as well as other wires for wireless purposes. All prices subject to change without notice.

KEYSTONE WIRE CO.
P. O. BOX 120, SCRANTON, PA.

Better Radiation



Heavy Formica supports
Inch and a quarter brass ribbon

Price - - \$14.50

Dealers, write for proposition.

T & H RADIO CO.

Anthony, Kansas
"Order via 9LR"

Do you know what a "dud" is?

IT is dough-boy slang for a high explosive shell which amid great fume and fuss has been shot forth to the enemy side and having once reached there falls to the ground and fails to explode. In other words, it is not what it is "cracked up to be" and has failed utterly in its mission.

Research work and much experimenting resulting from the skill and resources of the General Electric Company Research Laboratory prevent "duds" from finding their way into our products.

Radiotrons incorporate the knowledge resulting from the expenditures of vast sums in electrical research, yet they come to the experimenter at a price well within their purchasing ability. Secure one of these—it will prove a revelation in receiving qualities.

RADIOTRON U.V. 200 RADIOTRON U.V. 201



List Price \$5.00

A complete line of vacuum tube ACCESSORIES are now in manufacture and will shortly be available.

Dealers and Jobbers: We have an especially attractive proposition for you. Write us at once.

is the best detector and tone frequency amplifier brought out to date. It operates on a single standard plate battery and has proved excellent for amateur regenerative circuits.



List Price \$6.50

Ready for instant mailing: two valuable bulletins containing explicit and detailed data as well as many practical circuit diagrams employing these two Radiotrons.

The Radio Corporation's tubes are covered by patents dated November 7th, 1905; January 15th, 1907, and February 18th, 1908, as well as by other patents issued and pending. Tubes licensed for amateur and experimental use only. Any other use will constitute an infringement.

Address all orders and inquiries to:

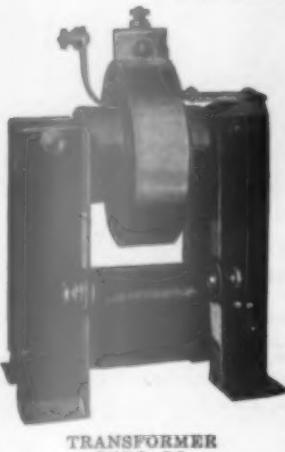
SALES DIVISION, COMMERCIAL DEPARTMENT

RADIO CORPORATION OF AMERICA

233 Broadway, New York City

THORDARSON APPARATUS

IMPORTANT! NOTE REDUCTIONS IN PRICES.



TYPE RS

A non resonant transformer with a low secondary potential designed to give you the highest possible power factor.

1 KVA 15000 volts.....	\$30.00
1/2 KVA 10000 volts.....	20.00
1/4 KVA 8000 volts.....	15.00

TYPE R—Resonant Transformers

1 KVA 25000 volts.....	\$40.00
3/4 KVA 10000 volts.....	28.00
1/2 KVA 10000 volts.....	22.00

Power Condenser (.0018-.009 MF).....	25.00
Oscillation Transformer.....	10.00
R8 Rotor (8 tooth).....	5.00
R16 Rotor (16 tooth).....	5.00
R12 Rotor (12 tooth).....	3.00

Specify diameter of motor shaft when ordering rotors.

Thordarson Electric Manufacturing Co.

517 S. JEFFERSON ST.,

CHICAGO, ILL.

Hams—

Why not get in on the long wave stuff?

Use Radisco Coils

Here is a combination that gets fine results for everybody that uses it—

LRD 1200 for Primary

LRD 1200 for Secondary

LRD 550 for Tickler.

Special Introductory Offer—

This combination sent anywhere in the U. S., postpaid, for \$6.50. Send your order to-day. The coils will be shipped immediately, and you can start right in on your long range work.

Kelly & Phillips

312 Flatbush Ave., Brooklyn, N. Y.

SAVE MONEY

We have a special offer on Receiving and Power Tubes

Stranded Antenna Wire	\$0.01
No. 4 Ground Wire.....	.10
Ground Switches.....	3.75
Contact Points..... per dozen	.25
Paragon Rheostats.....	1.70
2-FILAMENT AUDIO-TRONS	5.00
Amp. Transformers.. mounted	6.75
" " semimounted	4.75
" " unmounted	4.25

Above are only a few of our offerings. We stock knobs, dials, binding posts, receptacles, tubes, batteries, switches, etc.

WHITALL ELECTRIC CO.

42 MAIN ST., WESTERLY, R. I.

CALL LETTERS 11AP

The Corwin Mail Order Service

LETTERS continue to pour in from hundreds more amateurs, thanking us for the promptness and accuracy with which their orders were filled. If you want shipments the day your order is received, and apparatus that arrives in perfect condition, send your next order to Corwin. See if you need anything in this list.

Universal-Coil Mounting Plugs.

Anyone can easily make smooth-running mountings with these plugs. No bending, no filing, they are made to fit exactly, in the first place. Suitable for Radisco and all hand wound coils. A few minutes work with these plugs will save you dollars that can put into better apparatus!

Price 80 cents, postpaid

VARIABLE CONDENSERS

A.R.CO. .001	\$6.25
A.R.CO. .0005	5.00
With No. 67 Dial add.....	1.00
Murdock 368	4.75
Murdock 367	4.75
Murdock 368	3.75
Clapp-Eastham 800	7.50
Clapp-Eastham 800A	6.50
Clapp-Eastham 800B	11.50
Complete with dial	
Shipping Weight One Pound.	

GRID CONDENSERS

Radisco, postage35
------------------------	-----

ANTENNA SWITCHES

Murdock, 3 pounds	\$4.50
Clapp-Eastham, 10 pounds	12.50

OSCILLATION TRANSFORMERS

Radisco No. 5	\$15.00
Via Express collect only.	

RADIO CRAFT PRODUCTS

Detector	\$15.00
Two step Amplifier	80.00
Detector and one step	45.00
Detector and two step	70.00
Postage paid.	

"B" BATTERIES

Radisco No. 1 (2 lbs.)	\$1.50
Radisco No. 5 (5 lbs.)	2.65

Eveready Storage Battery
prices on application.

TUSKA C.W. APPARATUS

181 Coil (2 lbs.)	\$7.50
182 Coil (2 lbs.)	10.00
183 Coil (3 lbs.)	12.50
170 Filt. (8 lbs.)	16.00

AERIAL WIRE

7x22 tinned copper	
100 feet 2 lbs.	\$1.25
200 feet 4 lbs.	2.40
500 feet 8 lbs.	6.00

AMPLIFYING TRANSFORMERS

A.R. Co. (1 lb.)	\$5.00
Federal (1 lb.)	7.50
JACKS AND PLUGS	
Federal Closed Circuit	\$0.85
Federal Open Circuit .....	.70
Federal Double Circuit	1.00
Federal Plug	2.00

Postpaid

ALL RADISCO COILS and
Wireless Press Books.

VACUUM TUBES

Electron Relays	\$6.00
VT Amplifier (1 lb.)	7.00
VT Extra hard	7.50

ROTARY SWITCHES

Clapp-Eastham No. 19	\$1.00
Clapp-Eastham No. 19A .....	.35

Our Own No. 1 .....	.40
Our Own No. 2 .....	.55

Postage05
---------------	-----

CORWIN DIALS

No. 68, 3"	\$0.75
No. 67, 3" with knob	1.30
No. 68, 3 1/4"	1.00
No. 69, 3 1/4" with knob	1.70

Postpaid

RECEIVERS

Murdock No. 55, 2000 ohm	\$4.50
Murdock No. 55, 3000 ohm	5.50
Brandes Superior	7.00
Baldwin C	16.50
Baldwin E, improved	20.00
Brownlie new	12.00

Shipping weight, 2 pounds.

CONTACT POINTS

CP No. 1, Brass, dozen .....	.25
CP No. 4, Brass, dozen .....	.35
CP No. 5, Nickel Plated .....	.45

Postpaid

VARIOMETERS

Radisco No. 1	\$7.50
Radisco No. 1D	8.75

3 pounds.

VARIO-COUPLES

Radisco No. 2	\$8.50
Radisco No. 2D	9.50

3 pounds.

LOOSE COUPLERS

Clapp-Eastham Radion	\$14.00
Murdock 344	9.00

6 pounds.

GROUND OUTFIT

Consists of SPDT 500 Amp. Switch, 25 feet No. 4 wire, clamp and cleats, prepaid	\$7.00
---	--------

VT SOCKETS

Murdock	\$1.00
Radio Service, Double	3.00
Radio Service, Triple	4.00

Shipping Weight, 1 pound.

All orders for apparatus not listed as postpaid
must be accompanied by postage charges.

SEND TEN CENTS FOR CATALOG.

A. H. CORWIN & COMPANY

Dept. D.4.,

4 West Park Street, Newark, New Jersey

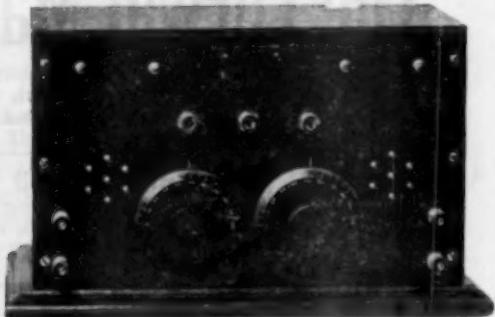
"Penn - C" Apparatus



Type D Panel



Type D Amplifier



Type E 2 Step Amplifier

Type D Panel Audion—Formica Panel satin finish 6 x 7 1/4 x 1 Murdock Socket, Grid Condenser, Paragon Rheostat, Bus Wiring Equipped with Filament and B Battery Switch—Price without bulb or batteries \$11.50.

Type D Panel Amplifier One Step Same as Panel Audion But Equipped with amplifying Transformer—Price without bulb or batteries \$17.50.

Type E Cabinet 2 Step Amplifier has 3 Telephone Jacks for Detector 1st Step and 2nd Step Jacks control filaments, Corwin Dials, Paragon Rheostats. Acme Amp. Transformers; Oak Cabinet, Satin Finish Formica—Front, top and back. Price, without bulbs or B batteries \$42.00.

Write for our literature on Penn C Apparatus.

THE P & M RADIO COMPANY

25 E. Woodlawn Ave.,

SRW

Niles, Ohio

Save Your Audion Bulbs With The C-Z Filament Protector

Greatest Invention since
the Vacuum Tube

Nine-tenths of the vacuum tubes used today are burned out before their life is spent and most times when they are new—by accident. With the C-Z filament protector in the circuit YOU CANNOT BURN OUT AN AUDION NO MATTER WHAT YOU DO.

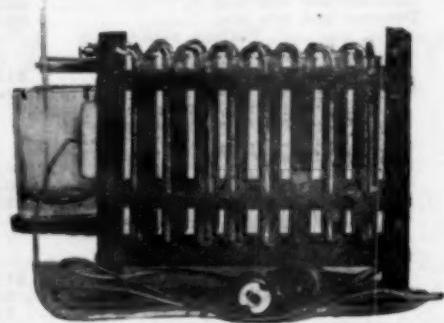
Blue prints and instructions with each instrument permit even the beginner to connect the instrument in circuit in one or two minutes. These instruments are for panel mounting. They can be mounted inside your ordinary control panel without changing the wiring. Each instrument is calibrated before leaving the factory.

C-Z Filament protector as described with signal light. \$5.00. Add postage for one pound.



Crescent City Radio Company

Dept. N. P. O. Box 1104, New Orleans, La.



STORAGE B BATTERY

complete with electrolytic rectifier for charging battery from any 110 V. A.C. line. Makes no noise while charging, requires almost no attention, and is guaranteed to be absolutely reliable.

32 Volt.....	\$11.00
48 Volt.....	13.00
64 Volt.....	15.00

We are proud to say that our batteries are rapidly being adopted as a standard equipment in up to date stations.

Write for descriptive circular.

CRAIG MFG. CO.
ENSLEY,

Members of A.R.R.L.

ALA.

RUB YOUR EYES AGAIN !

TALK ABOUT SALE—HERE'S A GOOD ONE

(By special popular request, we are extending this record breaking sale for 30 days more. If you missed out in the opportunities offered in our ad. in the Jan. "QST" here's your chance now!)

—And the reason for the sale? Well it's this. The C. and S. Catalog is ready. We need your address to send you a catalog. So we figured that by offering these remarkably low prices you will grasp the opportunity and order some apparatus. Thus, we will secure your address and send you a catalog. So in this ad we are offering superlative apparatus selling at EXTREMELY LOW PRICES.

ABSOLUTELY THE LAST OFFERING

THIS EXTRAORDINARY LIBERAL OFFER POSITIVELY EXPIRES IN 30 DAYS

The "Old Reliable" Short Wave Amplifying Receiver

SPECIAL
PRICE

ONLY

\$35

Express
Two Dollars
extra.



Only One
Receiver
Sold
To A
Customer

The super-sensitive, super-selective, and super-efficient short wave amplifying receiver of wide renown. We guarantee this receiver to be the best of its kind sold today. Get one today and receive those signals at marvelous intensity. Amplification 100 times. Complete improved receiver ready to connect up as a regenerative, only \$35.

Genuine "Radiotrons"

Those ultra super-sensitive detector and amplifier bulbs. Absolutely the best bulbs sold. Detector operates on 22½ plate voltage; amplifier 45 volts. For maximum results and efficiency you should use "radiotrons." Order today—while the price is low!



Regular \$5.00

Detector UV 200
Special price only

\$4.50

Postage 1 lb.

NOT MORE THAN SIX OF EITHER
BULBS SOLD TO A CUSTOMER.

BAKELITE PANELS

6 inch x 6 inch x ½ inch only 80c. Postage 1 lb.
12 inch x 6 inch x ½ inch only \$1.77. Postage 1½ lbs.

Regular \$6.50

Amplifier UV 201
Special price only

\$6.00

Postage 1 lb.



SAVE MONEY; BUY TODAY—AT ONCE

Orders Filled in Rotation.

THE C and S RADIO-ELECTRIC CO.

Dept.
Q-2-21

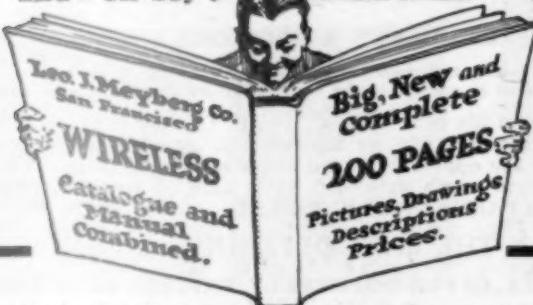
OMAHA

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

for you

and---oh boy!

it's Some book!



Yes—for YOU, you radio amateurs who live in the great West, for you particularly. Because it lists, pictures, and describes the complete radio lines of this big Western Radio supply house from whom you can get every bit of radioapparatus and wireless telephone equipment you need—quickly and cheaply, right in your territory. And select it all from this one big, handy book.

Newest, latest, and best radio equipment shown, described, explained, and priced in a single comprehensive volume. You need it as a complete catalogue. You need it as an up-to-date reference book. You need it as an instructive radio manual. You need it as a guide in the selection, purchase, and use of CW and Radiophone equipment. Send 35c in stamps NOW and get your copy by return mail. Don't delay—the supply is limited. The 35c is refunded with your first \$1.50 purchase from us. Address—

Leo J. Meyberg Co. 428 Market St., San Francisco, Cal.

Successors to Haller Cunningham Electric Co.

All standard makes of apparatus. Pacific Coast Distributors for A. H. Grebe & Co., General Radio, Pacent Electric Co., and Dubilier Condensers. The big, new catalogue-manual contains all. Send for it NOW.

WHILE THEY LAST

Chicago Radio Lab. AGN-2's—detector and 2 step—at old price \$95.00
Magnavox at old prices

Small horn	\$75.00
Large horn	\$95.00

TESTING STATION 8ZR.

Just let us know what U want—we have it.

Immediate Deliveries on following apparatus: THORDARSON, CHICAGO RADIO LAB., GREBE, BALDWIN, DUBILIER, BENWOOD, MAGNAVOX, AMRAD, DE FOREST, WIRELESS MFG. CO., and used goods. TRY US.

THE AMERICAN RADIO SALES AND SERVICE CO.

Great American Bldg.,

Mansfield, Ohio

RADIO CLUB PINS



Special folder of designs and prices in addition to regular school pin and ring catalog free on request. Be sure to see these new numbers which will put new life in your club.

METAL ARTS CO.

Dept. 10,

Rochester, N. Y.

ARLINGTON TESTED CRYSTALS



For over five years the accepted standard for crystal detectors. Galena or Silicon, individually tested and packed in tin containers, post paid. 35¢ crystal.

35¢

THE NEWMAN-STERN CO.
Dept. Q S T Cleveland, O.

NEW 1920 RED HEAD PHONES



\$12.50

We announce the new model of the famous Red Head Radio Receivers, greatly improved, 3200 ohms, \$12.50 the pair. Write for Bulletin F6. Distributors for De Forest, Murdoch, Signal, Bunnell.

THE NEWMAN-STERN CO.
Dept. Q S T Cleveland, O.

NEW APPARATUS



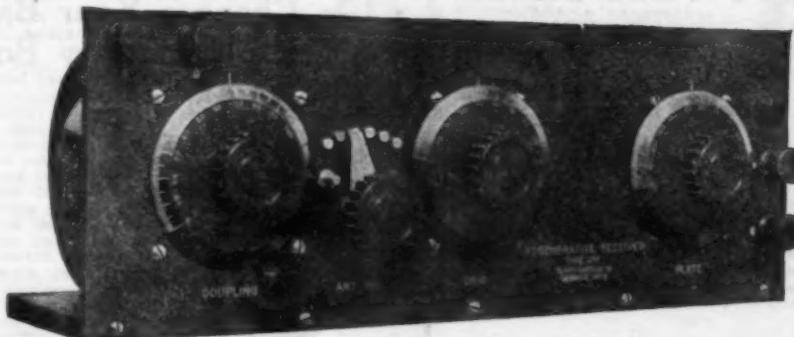
Type Z.R.V. Variometer has unit construction with bakelite shell and hard wood ball. Has low dielectric losses and a range of inductance of 1.25 mil henry maximum to .1 mil henry minimum. Is readily used on table or mounted on panels.

Complete with 3" dial and knob . . . \$6.50
Without dial or knob \$5.75
Varicoupler of same construction \$7.50



A combination of beauty and convenience. Detector panel has plug connection which takes your regular phone tips. One stage amplifier has binding posts for connecting two as a two stage amplifier. All binding posts on detector, amplifier and Regenerative set correspond for jumper connection.

Tube Control Detector Panel, Z.R.D. \$12.00
One Stage Amplifier Panel, Z.R.A. \$18.00
Rheostat only \$1.20



Z.R.F. Regenerative Receiver consists of two Z.R.V. Variometers and a Coupler of similar construction, together with Grid Condenser and Grid Leak with Bakelite Panel machine engraved. Licensed under Armstrong U. S. Patent No. 1,113,149. This exactly matches our Tube Control and Amplifier panels with which it may be harmoniously used. Its range of wave length is 175 to 600 meters. Price . . . \$38.00

Co-operate with your local dealer by helping him to carry a stock of Clapp-Eastham Co. apparatus, famous for its reliability during 13 years of continuous manufacture. If he doesn't carry our instruments send 6c stamps for our complete catalogs.

CLAPP-EASTHAM CO., 114 Main St., Cambridge, Mass.

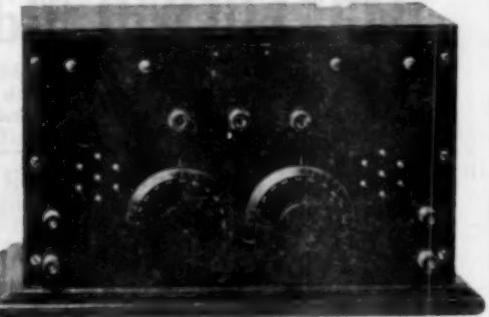
"Penn - C" Apparatus



Type D Panel



Type D Amplifier



Type E 2 Step Amplifier

Type D Panel Audion—Formica Panel satin finish $6 \times 7\frac{1}{4} \times \frac{1}{8}$ Murdock Socket, Grid Condenser, Paragon Rheostat, Bus Wiring Equipped with Filament and B Battery Switch—Price without bulb or batteries \$11.50.

Type D Panel Amplifier One Step Same as Panel Audion But Equipped with amplifying Transformer—Price without bulb or batteries \$17.50.

Type E Cabinet 2 Step Amplifier has 3 Telephone Jacks for Detector 1st Step and 2nd Step Jacks control filaments, Corwin Dials, Paragon Rheostats. Acme Amp. Transformers; Oak Cabinet, Satin Finish Formica—Front, top and back. Price, without bulbs or B batteries \$42.00.

Write for our literature on Penn C Apparatus.

THE P & M RADIO COMPANY

25 E. Woodlawn Ave.,

SRW

Niles, Ohio

Save Your Audion Bulbs With The C-Z Filament Protector

*Greatest Invention since
the Vacuum Tube*

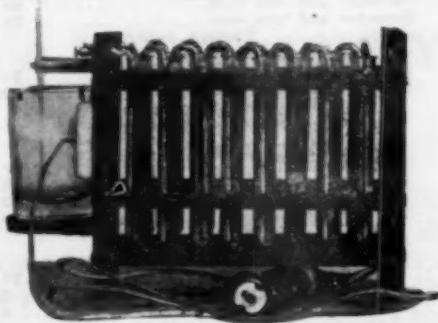
Nine-tenths of the vacuum tubes used today are burned out before their life is spent and most times when they are new—by accident. With the C-Z filament protector in the circuit YOU CANNOT BURN OUT AN AUDION NO MATTER WHAT YOU DO.

Blue prints and instructions with each instrument permit even the beginner to connect the instrument in circuit in one or two minutes. These instruments are for panel mounting. They can be mounted inside your ordinary control panel without changing the wiring. Each instrument is calibrated before leaving the factory.

C-Z Filament protector as described with signal light, \$5.00. Add postage for one pound.



Crescent City Radio Company
Dept. N, P. O. Box 1104, New Orleans, La.



STORAGE B BATTERY

complete with electrolytic rectifier for charging battery from any 110 V. A.C. line. Makes no noise while charging, requires almost no attention, and is guaranteed to be absolutely reliable.

32 Volt.....	\$11.00
48 Volt.....	13.00
64 Volt.....	15.00

We are proud to say that our batteries are rapidly being adopted as a standard equipment in up to date stations.

Write for descriptive circular.

CRAIG MFG. CO.
ENSLEY, ALA.
Members of A.R.R.L.

RUB YOUR EYES AGAIN !

TALK ABOUT SALE—HERE'S A GOOD ONE

(By special popular request, we are extending this record breaking sale for 30 days more. If you missed out in the opportunities offered in our ad. in the Jan. "QST" here's your chance now!)

—And the reason for the sale? Well it's this. The C. and S. Catalog is ready. We need your address to send you a catalog. So we figured that by offering these remarkably low prices you will grasp the opportunity and order some apparatus. Thus, we will secure your address and send you a catalog. So in this ad we are offering superlative apparatus selling at EXTREMELY LOW PRICES.

ABSOLUTELY THE LAST OFFERING

THIS EXTRAORDINARY LIBERAL OFFER POSITIVELY EXPIRES IN 30 DAYS

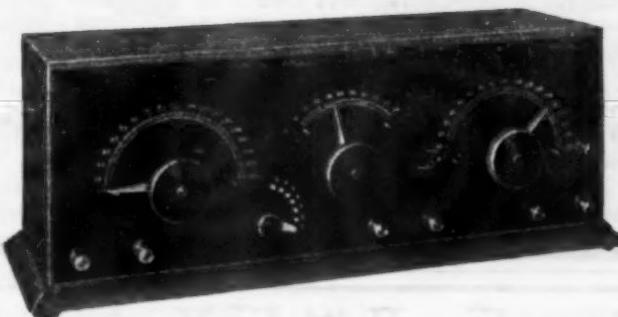
The "Old Reliable" Short Wave Amplifying Receiver

SPECIAL
PRICE

ONLY

\$35

Express
Two Dollars
extra.



Only One
Receiver
Sold
To A
Customer

The super-sensitive, super-selective, and super-efficient short wave amplifying receiver of wide renown. We guarantee this receiver to be the best of its kind sold today. Get one today and receive those signals at marvelous intensity. Amplification 100 times. Complete improved receiver ready to connect up as a regenerative, only \$35.

Genuine "Radiotrons"

Those ultra super-sensitive detector and amplifier bulbs. Absolutely the best bulbs sold. Detector operates on 22½ plate voltage; amplifier 45 volts. For maximum results and efficiency you should use "radiotrons." Order today—while the price is low!

Regular \$5.00

Detector UV 200
Special price only

\$4.50

Postage 1 lb.

NOT MORE THAN SIX OF EITHER
BULBS SOLD TO A CUSTOMER.

Regular \$6.50

Amplifier UV 201
Special price only

\$6.00

Postage 1 lb.



BAKELITE PANELS

6 inch x 6 inch x 1/8 inch only 89c. Postage 1 lb.
12 inch x 6 inch x 1/8 inch only \$1.77. Postage 1 1/2 lbs.

SAVE MONEY; BUY TODAY—AT ONCE

Orders Filled in Rotation.

THE C and S RADIO-ELECTRIC CO.

Dept.
Q-2-21

OMAHA

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

for you

and---oh boy !

it's Some book!



Yes—for YOU, you radio amateurs who live in the great West, for you particularly. Because it lists, pictures, and describes the complete radio lines of this big Western Radio supply house from whom you can get every bit of radioapparatus and wireless-telephone equipment you need—quickly and cheaply, right in your territory. And select it all from this one big, handy book.

Newest, latest, and best radio equipment shown, described, explained, and priced in a single comprehensive volume. You need it as a complete catalogue. You need it as an up-to-date reference book. You need it as an instructive radio manual. You need it as a guide in the selection, purchase, and use of CW and Radiophone equipment. Send 35c in stamps NOW and get your copy by return mail. Don't delay—the supply is limited. The 35c is refunded with your first \$1.50 purchase from us. Address—

**Leo J. Meyberg Co. 428 Market St., San Francisco, Cal.
Successors to Haller Cunningham Electric Co.**

All standard makes of apparatus. Pacific Coast Distributors for A. H. Grebe & Co., General Radio, Pacon Electric Co., and Dubilier Condensers. The big, new catalogue-manual contains all. Send for it NOW.

WHILE THEY LAST

Chicago Radio Lab. AGN-2's—detector and 2 step—at old price \$95.00
Magnavox at old prices

Small horn	\$75.00
Large horn	\$95.00

TESTING STATION 8ZR.

Just let us know what U want—we have it.

Immediate Deliveries on following apparatus: THORDARSON, CHICAGO RADIO LAB., GREBE, BALDWIN, DUBILIER, BENWOOD, MAGNAVOX, AMRAD, DE FOREST, WIRELESS MFG. CO., and used goods. TRY US.

THE AMERICAN RADIO SALES AND SERVICE CO.

Great American Bldg.,

Mansfield, Ohio

RADIO CLUB PINS



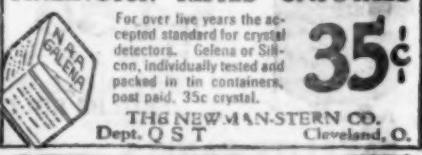
Special folder of designs and prices in addition to regular school pin and ring catalog free on request. Be sure to see these new numbers which will put new life in your club.

METAL ARTS CO.

Dept. 10,

Rochester, N. Y.

ARLINGTON TESTED CRYSTALS



35¢

THE NEWMAN-STERN CO.
Dept. Q S T Cleveland, O.

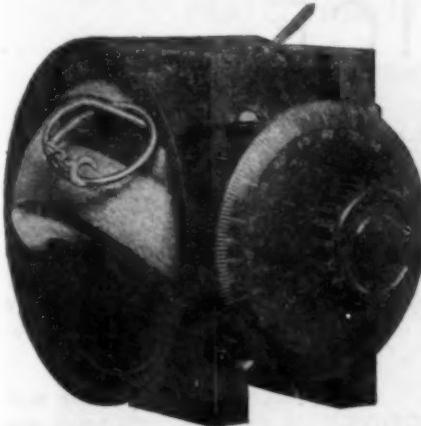
NEW 1920 RED HEAD PHONES

We announce the new model of the famous Red Head Radio Receivers, greatly improved, 3200 ohms, \$12.50 the pair. Write for Bulletin F6. Distributors for De Forest, Murdock, Signal, Bunnell.

THE NEWMAN-STERN CO.
Dept. Q S T Cleveland, O.



NEW APPARATUS



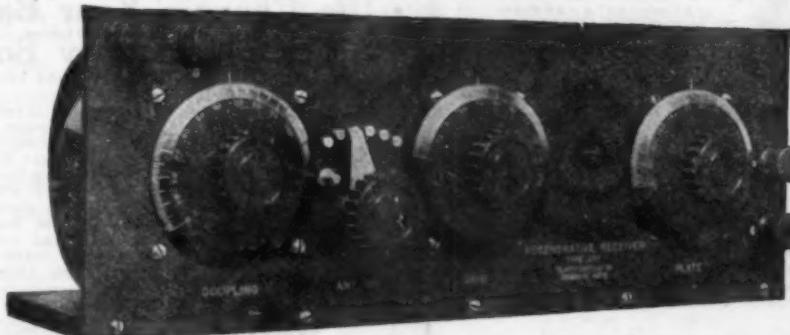
Type Z.R.V. Variometer has unit construction with bakelite shell and hard wood ball. Has low dielectric losses and a range of inductance of 1.25 mil henry maximum to .1 mil henry minimum. Is readily used on table or mounted on panels.

Complete with 3" dial and knob . . \$6.50
Without dial or knob \$5.75
Varicoupler of same construction \$7.50



A combination of beauty and convenience. Detector panel has plug connection which takes your regular phone tips. One stage amplifier has binding posts for connecting two as a two stage amplifier. All binding posts on detector, amplifier and Regenerative set correspond for jumper connection.

Tube ControlDetector Panel, Z.R.D. \$12.00
One Stage Amplifier Panel, Z.R.A. \$18.00
Rheostat only \$1.20

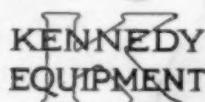


Z.R.F. Regenerative Receiver consists of two Z.R.V. Variometers and a Coupler of similar construction, together with Grid Condenser and Grid Leak with Bakelite Panel machine engraved. Licensed under Armstrong U. S. Patent No. 1,113,149. This exactly matches our Tube Control and Amplifier panels with which it may be harmoniously used. Its range of wave length is 175 to 600 meters. Price . . . \$38.00

Co-operate with your local dealer by helping him to carry a stock of Clapp-Eastham Co. apparatus, famous for its reliability during 13 years of continuous manufacture. If he doesn't carry our instruments send 6c stamps for our complete catalogs.

CLAPP-EASTHAM CO., 114 Main St., Cambridge, Mass.

SERVICE



YOU will find our mail order service useful and satisfying if you are unable to obtain Kennedy Equipment from your dealer. Leading electrical stores in many localities sell our apparatus and more are being constantly equipped, but we have established our mail order service for the radio experimenter whose dealer is not yet supplied.

CONSISTENT with our manufacturing policy of "QUALITY FIRST", our mail order policy is "SERVICE AND SATISFACTION." A post card will bring you our price list of parts. Give us a trial.

THE COLIN B. KENNEDY COMPANY RIALTO BUILDING

SAN FRANCISCO



NEW YORK

BOSTON

Offers a thorough course in all branches of wireless telegraphy. Radio Operators earn at the start \$125.00 per month, and first class board, etc., free.

Our school prepares you for your license in three to four months. Positions guaranteed to first grade licensed operators.

Day and evening classes.

The Leading Nautical School in U.S.A.

Established 1804

CAPTAIN F. E. UTTMARK, Principal

Write, call or phone for illustrated booklet

8 STATE ST., NEW YORK, N. Y.

Facing Battery Park, N. Y.
Telephone, Bowling Green 8079

UTTMARK'S for Nautical Education

Wireless Operators—Experimenters—
Auto Owners—Battery Users

10c. Charges Your Battery AT HOME WITH AN F-F Battery Booster

and your station will never be closed because of a discharged battery.



Is it not gratifying to feel that your filament battery will always be ready when you want it and that you will never have to give up in disgust when working a distant station?

F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up.

These F-F Boosters or Magnetic Rectifiers operate from 105-125 Volt 60 Cycle Alternating Current and rectify both alternations of the current thru carbon electrodes.

Bantam Type 6 charges 6 V. Battery at 6 Amps. \$15. Standard Type 166 charges 6 V. Battery at 12 Amps. \$32.

Shipping Weights 10 and 15 lbs.

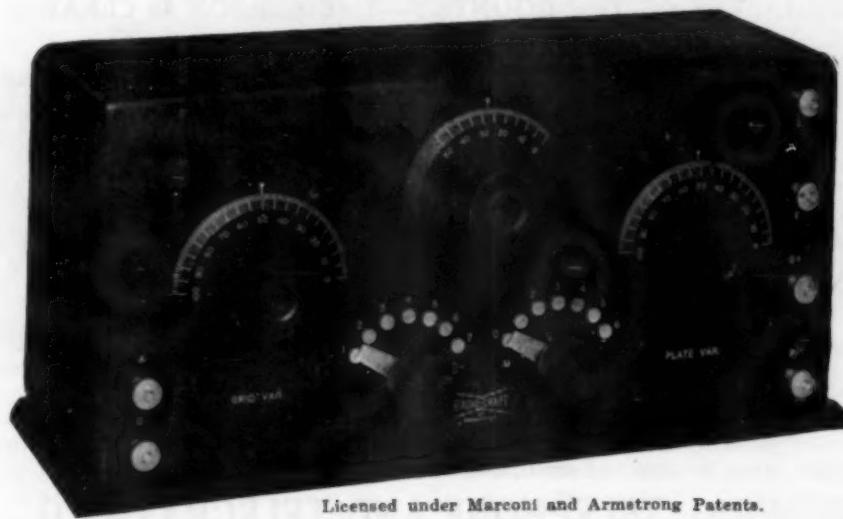
Also F-F Battery Boosters for charging batteries from Farm Lighting Plants and Direct Current Circuits. Order from your dealer or send check for prompt express shipment. If via P. Post have remittance include postage and insurance charges. Will also ship C.O.D. Our factory is buzzing steadily to take care of your requirements.

ORDER NOW OR WRITE FOR BULLETIN NO. 81

The France Mfg. Co. Office & Works
CLEVELAND, OHIO

RADIO-CRAFT PRODUCTS

PERFECTION IN RADIO INSTRUMENTS



Licensed under Marconi and Armstrong Patents.

Short wave regenerative receiving set with wave length range from 125 to 550 meters.

PRICE - - - \$65.00

FOR SALE BY

Atlantic Radio Co., Boston, Mass.
Continental Radio & Electric Corp., New York City
Freeman-Sweet Co., Chicago, Ill.
Howell Bros., Richmond, Va.
F. S. Katzenbach & Co., Trenton, N. J.
Manhattan Electrical Supply Co., New York City
McCarthy Bros. & Ford, Buffalo, N. Y.
Nevada Machinery & Electric Co., Reno, Nevada
Philadelphia School of Wireless Telegraphy, Phila., Pa.
Radio Distributing Co., Newark, N. J.
Rudolph Schmidt & Co., Rochester, N. Y.
Southwest Radio Supply Co., Dallas, Texas
Westchester Electrical Appliance Co., Yonkers, N. Y.
Jos. M. Zamoiski & Co., Baltimore, Md.



DETECTOR AND TWO-STAGE AMPLIFIER

Size:—8½" x 8¼" x 4"
PRICE - - - \$70.00

RADIO-CRAFT CO., INC., Brooklyn, New York
Jobbers Inquiries Invited

Federal Radio Accessories

ARE RECOMMENDED AND ENDORSED BY THE LEADING RADIO
ENGINEERS OF THE COUNTRY—THE REASON IS CLEAR—
THEY GIVE THE RESULTS.



U.V. 200
and
U.V. 201

The No. 226-W Transformer surpasses all others when used with the U.V. 200 and U.V. 201 Radiotrons—and other tubes now on the market.

THIS IS A PROVEN FACT.

Federal Jacks, Plugs, Buzzers, Switches, Etc. are unquestionably the most popular and best made items on the market.



No. 226-W

Ask your dealer for Federal products. If he does not have them, tell us his name. All orders promptly filled. We are distributors of the U.V. 200 and U.V. 201 tubes, and other tubes in large and small lots.

FEDERAL TELEPHONE AND TELEGRAPH CO.
BUFFALO, N. Y.

Makers of standard accessories. Bulletin 102 W.B. 4 cents.

R
KLAUS
D
I
O

"The
Guarantee
of
Satisfaction"

When you see this Mark you will know that it signifies SERVICE—RELIABILITY—the Indelible Stamp of Superior Quality.

Our hundreds of customers and dealers know that "KLAUS RADIO" is synonymous with Square Dealing.

We take this opportunity to extend to our friends and patrons, Best Wishes for a Happy and Prosperous New Year.

KLAUS RADIO CO.
EUREKA ILL.

HEY !! 'BUGS'

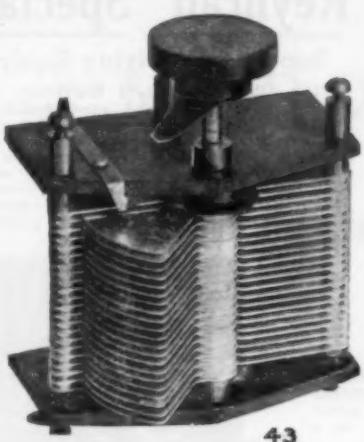
Here's Something NEW. It's the GUSTAFSON VERNIER DIAL CONTROL. A neat little device and a necessity on every receiving outfit, gives a fine vernier or micrometer adjustment to your dials. NO CAPACITY EFFECT, rapid adjustment, cannot get out of order; can be applied to your present cabinet in two minutes. The vernier indicating dial is graduated in hundredths, giving very fine adjustment; long handles permitting adjustment without 'body effect'.

Everyone that sees it says: "It's the grandest thing I ever saw, don't see how I ever got along without it, and so simple, practical and neat; you ought to sell a million" AND WE WILL! at the price—

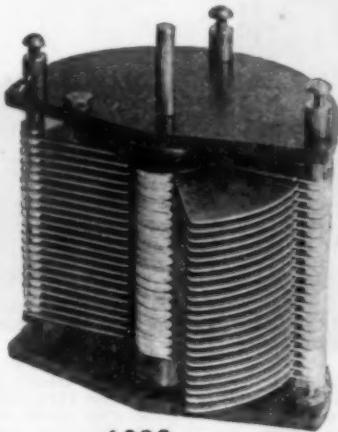
SPECIAL INTRODUCTORY OFFER
\$1.00 ea.—3 for \$2.50—\$9.00 a dozen
POSTPAID

Better get yours now, before we are swamped with orders. Orders strictly filled in rotation as received. We have a large supply, but they won't last long. Order yours NOW.

GUSTAFSON BROS.
Quality Apparatus
1402 N. HICKORY ST., JOLIET, ILL.
WATCH FOR THE BIG ANNOUNCEMENT!!!



43



4300

ANNOUNCING

Our NEW SERIES "T" VARIABLE CONDENSER.

A heavier model than our SERIES "S", but built along the same general lines. Plates are of $\frac{1}{16}$ " aluminum.

We SPECIALIZE on ONLY THE BEST. SATISFACTION GUARANTEED.

PRICES

SERIES "T"

No. 20	2 plate Vernier.....	\$2.00
No. 70	7 plate .0001 m.f....	2.35
No. 130	13 plate .0002 m.f....	2.75
No. 170	17 plate .0003 m.f....	3.15
No. 230	23 plate .0005 m.f....	3.60
No. 310	31 plate .0007 m.f....	4.30
No. 430	43 plate .001 m.f....	5.25
No. 630	63 plate .0015 m.f....	7.50

Include postage for one pound on SERIES "T" condenser, and for two pounds on SERIES "L".

SERIES "L"

No. 2300	23 plate .00075.....	\$6.00
No. 4300	43 plate .0013	8.00
No. 6300	63 plate .002	10.00

Indicating Dial fitted to either style condenser for 75c extra.

NOTICE: Owing to shortage on certain materials, we are unable to fill orders for SERIES "S" Condenser at this time, but can ship NEW SERIES "T" and SERIES "L" from stock.

The Wireless Shop

511 W. Washington St.

A. J. Edgcomb.

Los Angeles, Cal.

RHAMSTINE ★ Radio Products



Plug and Jack
Complete \$1.50
Add Postage 4c.

Efficient nickel plated Plug and Jack. Cords easily attached to Plug connection. Contacts automatically connect transformer

Can be used in any set. Indispensable in one and two step amplifiers. Eliminates binding posts and switches. Circular on request. Attractive Dealer proposition.

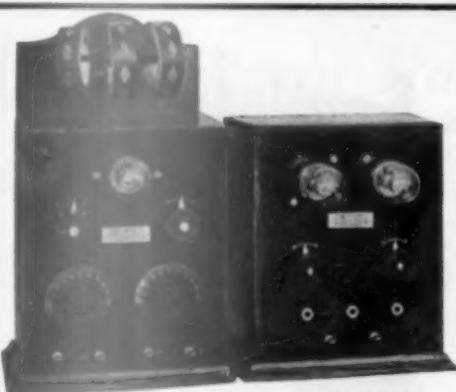
RHAMSTINE★ 2152 Larned St. E. DETROIT, MICH.
★RADIO JACKS AND PLUGS

Laboratory Signs

Attractive 5" x 10" signs printed on high quality coated white cardboard in selected wordings for the electrical experimenter.

1. DANGER! HIGH VOLTAGE
 2. EXPERIMENTAL RADIO LABORATORY NO ADMITTANCE
 3. GOVERNMENT LICENSED RADIO STATION
 4. DO NOT TOUCH THE INSTRUMENTS
 5. PLEASE BE QUIET WHILE THE OPERATOR IS RECEIVING
- 15 EACH, ANY TWO FOR 25c
ALL 5 FOR 50c
IMMEDIATE SHIPMENTS, POSTPAID.

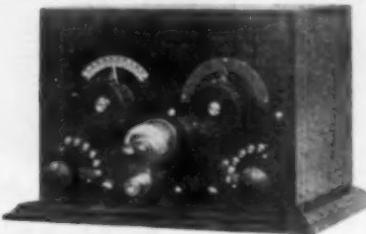
THE TAYLOR COMPANY
BOX 1043C, LOWELL, MASS.



Reynrad Specialties

Superior Receiving Equipment.

The "Reynrad" RR-74 Multiwave Tuner and Audion Detector is an exceptionally fine receiving outfit mounted as a cabinet unit. It is as efficient at 200 meters as it is at 20,000 meters. When used in conjunction with the RA-72 Two Step amplifier, at our testing station, music and radiophone conversations have been heard from both coasts—an exceptional record. The amplifier positively does not howl or squeal.



RCR-30 Crystal Set.

RR-74 and RA-72
With the RCR-30 Crystal Detector receiving set, we have repeatedly copied ship stations 1500 miles, chiefly overland, and amateur stations over 1000 miles away. This record places the RCR-30 Receiving cabinet on a par with many audion detector sets.

Note the original and artistic design of these instruments.
RR-74 Multiwave Tuner & Detector, with bulb only. \$60.00
RA-72 Two Step Amplifier, with Bulbs. 55.00
RCR-30 Crystal Receiving Set, with 3000 ohm phones. 30.00

REYNRAD SHORT WAVE COILS

Just what you have been looking for. Single layer inductances, wound on heavy 4" Bakelite tubes, with standard DeForest plugs. A set of three will bring in amateur stations as you never have heard them before. An additional secondary coil will make your receiving outfit equally efficient up to 600 meters. State wave length desired 175-300 or 300-600.

Reynrad Short Wave Coils. \$2.00 each
Standard DeForest Plugs for HC or DL coils.65 each

We carry a large stock of standard apparatus and supplies.

Acme, Murdock, Clapp-Eastham, Magnavox and DeForest Agents.
6c in stamps will bring our catalogue and place your name on our mailing list.

CORRESPONDENCE SOLICITED.

REYNOLDS RADIO SPECIALTY CO., 729 South Prospect St., Colorado Springs, Col.

EASTERN RADIO ELECTRIC CO.

Established

"FOR BETTER SERVICE TO THE AMATEUR"

We carry in stock a full line of Standard Wireless Apparatus and can make prompt shipment.

Murdock Phones (2000 ohms).....\$4.50

Murdock Phones (3000 ohms)..... 5.50

Brandes Superior Head Sets..... 7.00

Brandes "Transatlantic"..... 12.00

Brandes "Navy Type"..... 14.00

Brandes Superior with improved head band..... 8.00

Stromberg-Carlson Head Sets..... 12.00

Baldwin Phones "Type C"..... 16.50

Baldwin Phones "Type E"..... 20.00

Baldwin Phones "Type F"..... 21.00

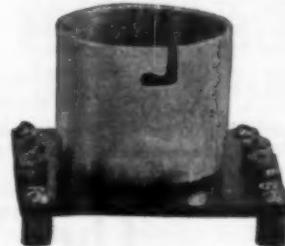
Write for our special proposition on Storage Batteries for Wireless Use.

"WE PAY POSTAGE"

EASTERN RADIO ELECTRIC CO.

1405 Florida Ave. (at 14th St.)

WASHINGTON : : D. C.



Type B-1 \$1.10

V.T. SOCKET—Type B-1.
Aluminum socket mounted on bakelite base.
PARAGON RHEOSTAT

For front or back mounting..... Each, \$1.75
UNMOUNTED COILS

(Machine wound with No. 24 enameled wire)
9" long x 2½" dia..... \$1.00
10" long x 3" dia..... 1.25

BAKELITE PANELS

9" x 9" x ½" \$1.75
9" x 19" x ½" 3.00
(Other sizes cut to requirements)

Send for quotation.

HEADSETS

Baldwin—Improved type E..... \$20.00

Brownlie..... 12.50

Brandes—Navy Type..... 14.00

Brandes—Transatlantic Type..... 12.00

Brandes—Superior Type..... 8.00

Murdock—2000 Ohms..... 4.50

Murdock—3000 Ohms..... 5.50

BAKELITE KNOBS

Type R-1—1½" dia. \$0.50

Type R-2—2" dia.60

McMAHON RADIO SUPPLY CO.

56 West Ave., So. Norwalk, Conn.

MURDOCK

No. 55

The prices are
unusually low

2000
OHM
DOUBLE SET
\$4.50



The quality is
remarkably high

3000
OHM
DOUBLE SET
\$5.50

FOR YOUR OWN SATISFACTION

We urge you to TRY a set, that you may realize what sensitive, serviceable, real radio receivers can be obtained at "rock bottom" prices. WHAT YOU SAVE can be applied to the purchase of other apparatus—AND—you can be sure that your station will be the gainer in both WAYS. Ask your dealer for them.

BULLETIN NO. 20 NOW READY FOR
DISTRIBUTION. ASK FOR YOUR COPY.

WM. J. MURDOCK CO.

65 Carter St.,

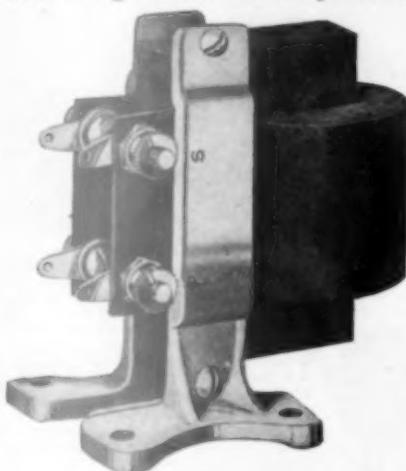
CHELSEA, 50, MASS.

509 Mission St.,

San Francisco, Calif.

A-A

AMPLIFYING TRANSFORMERS are constantly being RECOGNIZED as the MOST EFFICIENT intervalve transformers on the market. Use them with radiotron amplifiers obtaining maximum amplification.



—NO HOWLING AT THIRD STAGE—

See previous issues QST for specifications.

Due to drop in price of all materials and great increase in volume of our business we are glad to announce the following lowered prices.

A-A AMPLIFYING TRANSFORMER, mounted as illustrated	\$5.00
SEMI-MOUNTED, Unmounted with mounting unassembled...	\$4.50
UNMOUNTED	\$4.00

Shipments made from stock, prepaid. Satisfaction guaranteed or money refunded. We offer to Jobbers and Manufacturers of cabinets Attractive Propositions.

USED AND SOLD BY THE CHICAGO RADIO LABORATORY, CHICAGO, ILL.
HI-GRADE WIRELESS INSTRUMENT CO., ASHEVILLE, N. C.

ALL-AMERICAN ELECTRICAL MFRS., 815 Wisconsin Ave., OAK PARK, ILL.
—ENGINEERS—MANUFACTURERS—

CANADIAN RADIO EXPERIMENTERS

Lateral Wound Coils.

URNS	WAVE LENGTH	PRICE
25	130.375	\$0.55
40	225.575	.60
75	240.740	.70
100	460.1480	.80
175	750.2400	1.00
325	1375.4500	1.25
550	2250.7700	1.50
750	3000.11200	1.75
1200	6000.20000	2.50

Special sizes to order.

Plugs for these coils..... .60
AudioTrons, two Filament..... 8.50
AudioTrons, one Filament..... 7.50

Send for our catalogue.

J. M. PAQUIN

THE ELECTRICAL SHOP
787 Queen St. W., Toronto, Ont.

Mr. Francis Frazee Hamilton, E. E.

desires to thank cordially the many amateurs who have so kindly sent him reports of the signals of Station 9ZJ, Indianapolis.

\$1,000.00 REWARD

If any one can prove that our latest Invention, will not be copied or infringed by others.

? — MIDGET — ?

Other remarkable instruments being manufactured by this Corporation.

AMATEURS here is a new and beneficial organization for you to join.

AMATEURS WIRELESS RADIO CLUB OF AMERICA

Call 8GZ, "Copyright", Head Quarters.

Detroit Radio Laboratories Co.
3661 Gratiot Ave., Detroit, Mich.

PLATE BATTERIES CUSTOM MADE!

Made for Heavy Duty and Made to Last!
Batteries that Win Golden Praise from Every User!

A new 22½ volt unit made up of large size powerful flashlight batteries, soldered together with $\frac{1}{4}$ inch brass strip, the positive and negative terminals being of the same and drilled for bolt and nut connections.

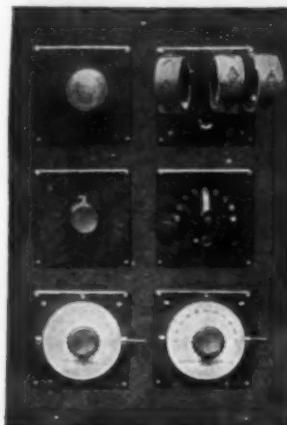
The VOLTAGE IS VARIABLE by means of clipping on to the brass strip connectors. NO WIRES TO BREAK OR CORRODE. SPECIAL-
LY MADE FOR LONG LIFE AND HEAVY DUTY.

Price f. o. b. anywhere in the U. S. \$2
Black fiber panel 7 x 20 x $\frac{1}{4}$ inches suitable for a Paragon set. \$3.

ECONOMY RADIO SUPPLIES CO.
232 Sanford Street, East Orange, N. J.

DE FOREST

Newest Ideas in DeForest Unit-System Receiving Apparatus



ADVANTAGES of the Unit-System include extreme economy due to the simplicity and interchangeability of the Units; convenience in arranging circuits to the individual need; and greater operating efficiency due to the engineering design and quality of the instruments. The Unit Sets shown here are a few examples.

Six Panel Unit Set

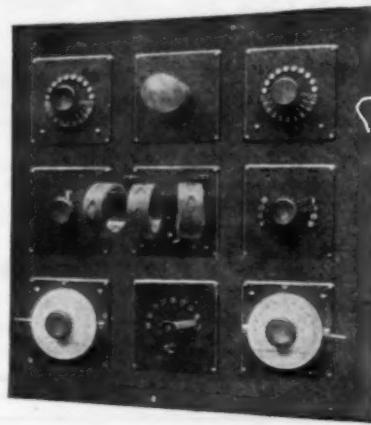
comprising a combined Tuner and Detector to receive all local stations and practically any large station in the world. Everything necessary for the operation of the set, including detector tube, "B" battery, head phones and a set of 11 coils, can be had for \$75.00 complete. (Purchaser to furnish panel board and "A" battery.) This set will give greater satisfaction than any outfit at anywhere near this price. Expansion possibilities unlimited.

Nine Panel Unit Set

comprising the same six panels shown above, and either three additional panels to give one step of amplification, or three panels to increase the efficiency of the original six. The former will add about \$23.70 to the cost of the original six; the latter about \$12.10.

DeForest Apparatus Prices Reduced

Prices on DeForest Radio Apparatus have been reduced until present prices are practically the same as were effective about one year ago.



DeForest Radio Telephone & Telegraph Company

Inventors and Manufacturers of High Grade Radio Apparatus

1407 Sedgwick Avenue

New York City

LEE DE FOREST, Inc., Western Distributors,
451 Third St., San Francisco, Cal.

DE FOREST

LEARN WIRELESS

at the largest radio school in the central states. Modern, complete equipment. Experienced instructors. Dormitory in connection. Students may earn expenses if necessary. Send today for catalogue and full information.

CENTRAL RADIO SCHOOL

Independence, Mo.

CENTRAL RADIO BUILDING—NINE MILES FROM THE HEART OF KANSAS CITY



THE MARK DESTINED
TO BECOME FAMOUS

CENTRAL STATES

amateurs save time and money by purchasing your apparatus from us. Our large stock assures prompt shipments, and our central location assures minimum transportation charges. All leading makes. Send today for latest bulletins.

CENTRAL RADIO CO., Inc.

513 W. Lexington St.
Independence, Mo.

Announcing the latest Audion Control Cabinet "The KO-RAD"

Quantity production enables us to offer the "Ko-Rad" Control Cabinet at only \$10.00.

This instrument incorporates features that are not excelled by any at treble our price.

Orders now being booked for February 15th delivery.

Oak cabinet "Early English" finish, size 5" x 5 1/4" x 4" deep. Genuine grained finish bakelite panel.

Shipping weight 5 lbs.

Standard VT socket, Paragon Rheostat, and fixed grid condenser, all back mounted on the drawer type panel, making the interior quickly accessible for inspection.

Variable grid leak, and hard rubber binding posts. Presenting an appearance that any station may well be proud of.

Place your order early. If your dealer can not supply you, order direct from this advertisement.



Complete ready to hook up, only
\$10.00
without bulb or batteries.

JOHN R. KOCH

Manufacturer and Distributor

Radio Apparatus and Supplies.

200 Capitol St.,

West Virginia

Charleston,

"Cosradio"
Mark of Quality

NO SEALS. NO SECRETS.
JUST SIGNALS AND VOICE.
—Short Wave Regenerative—



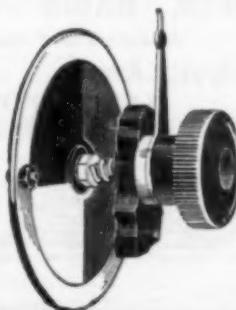
Better than many at twice the price.

CSR-2 with Dials.....	\$45.00
CSR-3 Engraved Scale.....	45.00
CSR-1 Short Wave and Audion Control.	72.50

Send for description.

COSRADIO CO., Wichita, Kans.

A NEW INVENTION



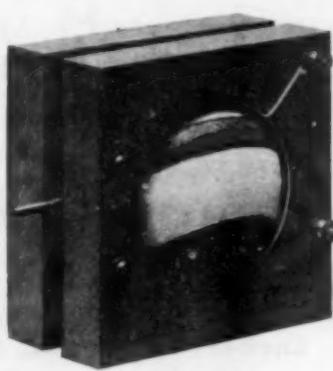
The PARKIN .001 mf. Variable Condenser (pat. pending) fills the long felt want for a rugged, low priced, balanced, variable condenser for panel mounting. No plates to bend and short circuit. Cannot get out of order. Has very low minimum capacity. Easily mounted, only one small hole being necessary in the panel.

Guarantee: ALL PARKIN Variable Condensers are sold subject to return within 5 days if not fully satisfactory.

No. 50. Unit only. May be mounted on any shaft. \$1.50
51. With knob, pointer, etc., as shown in cut. 2.00
52. With knob, etc., and 3" black dial..... 2.50

Postpaid
Write for full description of this new invention. Ask for circular No. 17.
Dealers: Write for discounts.

PARKIN MFG. CO., San Rafael, Calif.



VARIOMETER



VARIO-COUPLER

RADIO SHOP VARIOMETERS

Of original design embodying features not to be found in any others. Winding forms of seasoned stock especially selected for its non-shrinking and insulating qualities. Natural finish and treated for resistance to the elements. No dark stains, which invariably contain conducting properties, are used. Windings held in place by a special compound combining high mechanical strength with low distributive capacity—a very important item. Bearings of heavy brass bar, giving ample contact surface. This contact is strengthened by a phosphor bronze spring. Can not possibly groove the shaft. This bearing is an exclusive RADIO SHOP development. The clearance between stationary and rotating windings is correctly proportioned to give a wide and accurate range of adjustment with a minimum of distributive capacity. Shafts are of brass, one-quarter inch in diameter, milled to take a standard three-sixteenth inch dial.

Variometers, each \$10.00

RADIO SHOP VARIO-COUPLES

Of the approved rotating secondary type. Cylindrical primary winding, sectional tapped for six values of inductance. Secondary of ball type supported by aluminum castings of ample proportions and embodying the RADIO SHOP spring bearing as used in our variometers. Secondary does not rotate within the primary, but above it. This is on account of the loose coupling necessary for 200 meter work. Mounted on square wood base.

Vario-Couplers, each \$8.00

Standard Dials: To fit units. Three inches in diameter. Genuine Bakelite filled with brilliant white.

Dial, complete with Knob, \$1.30

We have some interesting printed matter on these and other RADIO SHOP products which will be mailed upon request.

All communications regarding RADIO SHOP products should be addressed direct to the RADIO SHOP as the California Electric Supply Company are no longer exclusive distributors.

THE RADIO SHOP,

San Jose, California

JEWELL THERMO-COUPLE METERS DO NOT LIE

They register the antenna current accurately.

Duration of current flow does not change reading.

Permanently adjusted
—No zero shift.

Used by U. S. Army,
U. S. Navy and Commercial Companies.



Pattern No. 25 Jewell Thermo-Couple
Shipping Weight 30 lbs.

Picture your set equipped with an accurate, sensitive, durable ammeter.

Make your picture real,

BUY A JEWELL

Price:

0-3 amp. \$15.00

0-5 amp. 15.00

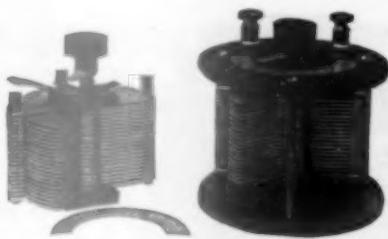
0-10 amp. 15.00

Prompt Deliveries.

DOUBLEDAY-HILL ELECTRIC CO.

RADIO DEPT.—DESK A

715 12th St., N. W., WASHINGTON, D. C. 719-21 Liberty Ave., PITTSBURGH, PA.



THE "ILLINOIS" VARIABLE CONDENSER

The Condenser with "Star Spring" Tension
MADE RIGHT - STAYS RIGHT
Hard Rolled Aluminum Plates

These condensers are made by a watch mechanic schooled in accurate workmanship and who can't get over the habit of critical inspection.

Three Styles: No. 1. Panel; No. 2. Open Type as shown; No. 3. Fully Enclosed. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

Style No. 1	No. 2	No. 3	Money back if not satisfied. Just return condenser within 10 days by insured P.P.
67 Plates,	\$7.00	\$	
48 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
18 "	2.25	3.25	3.50

With Style No. 1, we will, if desired, furnish 3 inch Dial with large knob, instead of Scale and Pointer.

Extra Price 75 cents.

Sent Prepaid on Receipt of Price.

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c. Foreign Orders other than Canada not solicited.

The "ILLINOIS" is rapidly adding to the number of its friends. The bouquets they fling only spur us to still more careful work, and more rigid inspection. It is a matter of pride that among the thousands of instruments sent out, not a single complaint has been received of bad condition. This may possibly be because every instrument is subjected to the scrutiny of the "old man's" eyeglass.

Patent is pending on the "Star Spring" feature, which is very valuable. The action of this spring produces an unvarying friction that holds the "rotor" in any position to which it may be set, and at the same time automatically centers the plates in relation to each other, and prevents any possibility of "endshake."

The plates are in proper relation by construction, and will remain so, obviating any necessity of readjustment. Once right, always right. Once mounted on your panel, there is one thing that you can depend upon to never give you trouble.

We thank our friends for their letters of generous appreciation.

Kindly note: We issue no Catalog, and make no "trade discounts". We set our prices at the lowest limit, and leave the "middle man" out for the sole benefit of the "consumer".

G. F. JOHNSON, 625 Black Ave., Springfield, Ill.

TELEGRAPHY

Both Morse and Wireless and RAILWAY ACCOUNTING taught thoroughly and quickly. Big salaries now paid. Great opportunities for advancement. Oldest and largest school; established 46 years. Endorsed by Telegraph, Railway, Radio, and Government officials. Expenses low—opportunities to earn large portion. Catalog free.

DOOCES INSTITUTE

Street, Valparaiso, Ind.

Attention Amateurs

G. E. Detector Tubes.....	\$5.00
A. P. Electron Relays.....	6.00
7 Strand Copper Wire, C. ft. 1.25	
7 Strand Copper Wire, per 1000 ft.....	10.00
Enamel Wire No. 22, 24, 26, 28 on 1 lb. spools, per lb.....	1.00
Also DeForest, Acme, Amrad, Radiocraft Products.	

The Quaker Light Supply Co.

728 Arch St., Philadelphia, Pa.

Attention of Mr. H. J. Dunbar.

DETROIT

NOW HAS A COMPLETELY STOCKED RADIO SUPPLY HOUSE CARRYING THE FOLLOWING HIGH GRADE LINES:

GREBE — ACME — THORDARSON — MURDOCK — CHELSEA — BENWOOD — TUSKA — FEDERAL — BURGESS, ETC.

MAIL ORDERS SOLICITED.

DETROIT ELECTRIC CO.

434 SHELBY ST., DETROIT, MICH.
ESTAB. 1886. PHONE MAIN 1406.



PATENT-SENSE
"The Book for Inventors & Mfrs."
By Return Mail FREE. Write
LACEY & LACEY, Dept. 9, Washington, D.C.

Quality WEACO Service

VT Sockets—\$0.90, \$1.00, \$1.20, \$1.50, \$1.75. New Radiotrons, \$5.00. Electron Relays, \$6.00. Signal Navy Type Reg. Receiver, \$37.50. 6 V. 60-80 amp. storage battery, guaranteed 2 years, \$20.00.

WESTCHESTER RADIO SERVICE
253 So. BROADWAY. YONKERS, N. Y.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

They Have Proved Their Merit— IN NEW YORK CITY AND VICINITY



Why not try them? Makes a perfectly balanced set with range of 160 to 600 meters.

The feature of the coupler is its inside wound primary.



J J N VARIOMETER — Specially prepared to overcome those loose windings so often found. Dimensions $4\frac{1}{4} \times 4\frac{1}{4} \times 2\frac{1}{2}$. Specify whether $\frac{1}{8}$ or $\frac{1}{4}$ shaft is desired. Price postpaid... \$4.50

For sale by **J J N VARIOCOUPLER** — With winding that will not come loose inside a non-shrinking, non-warping tube. Brought out to seven taps allowing close tuning. Specify whether $\frac{1}{8}$ or $\frac{1}{4}$ inch shaft is desired. Price postpaid \$5.00

J. & J. NIGHTINGALE, 741 Market Street, Paterson, N.J.

P R I C E S ■ S M A S H E D ■ S L A S H E D ■ C R I P P L E D —
Murdock sockets 89c; 2000 phones \$3.99; 3000 phones \$4.99; fixed cond. 63c; detector 63c; #366-43 plate var. in case \$4.25; 23 plate in case \$3.39; DeForest LS-100 loud speaker \$31.89; D-101 detector \$2.49; S-200 anti-cap. switch \$2.50; F-200 rheostat 92c; 2 filament Audiotrons \$5.25; A-P Electron Relay \$5.25; Amplifier \$6.25; Transmitter tube \$6.89; A-A amplifying transformer \$3.89; aerial wire, 7 str. tinned \$1.25 C; tested galena 2 for 30c; 8/32, 8/32 brass nuts 9c doz.; knob and lever 2 for 30c; nickelized, insulated B. Posts 10c ea., 95c doz., ORDER FROM AD. \$10 or more P.P. to zone 4. REMIT BY MONEY ORDERS, CERTIFIED CHECKS, Stamps accepted to \$1. AN INTRODUCTORY OFFER. ■ STOCK DEALERS PROTECTED. • 20% DISCOUNT on "Hi-Grade" complete panel and receiving outfits, on the 1st 5 orders from each city, of one or more items. Same discount on all types, detectors, amplifiers, tuners, long and short wave VT sets. Prices from \$2 to \$125. Stamp for full list. Terms: cash or 1/3 with order, balance C.O.D.

HI-GRADE WIRELESS INSTRUMENT CO., ASHEVILLE, N. C.

1/4 H. P., 110 volts,
A. C., 60 cycle,
single phase,
1750 R. P. M.
MOTORS

LARGE QUANTITIES NEW WASHING MACHINE MOTORS
These are of stamped construction and carry full factory guarantee.
Shipping is free by C. O. D. or money order. Suitable for washing, Coffee Grinders, Cream Separators, Bottles Washers, Air Compressors, Sewing Machines, Etc.

Mail 15c stamp or Money order.
We will send C.O.D. sub-
ject to full examination.
Money Back Guarantee.

Manufacturers Distributor
Catalogue Special Quantity Prices—Value \$25.00

\$22.75 Each

PHAS. H. JOHNSTON - Box 10 W. E. Pittsburgh, Pa.

NEW ORLEANS RADIO APPARATUS AND SUPPLIES

ROSE RADIO SUPPLY
604 GRAVIER STREET
NEW ORLEANS, LA.

Send 10c for Latest Catalogue

"JUPITER"

allows your transmitter energy to radiate from a broad surface of pure copper at a minimum resistance. Seven strands No. 22 solid copper. Strong and flexible. High conductivity plus 100% radiation.

1 1/2c Per Foot—\$12.00 Per Thousand

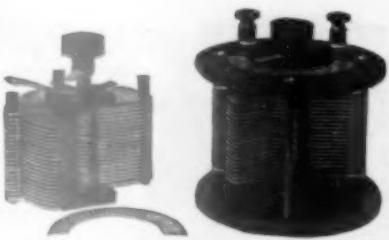
Shipping weight 15 lbs. per thousand. Send check or money order. No C.O.D.'s. Discount to Clubs, Colleges and A.R.R.L. officials. Immediate delivery.

LEE A. BATES,

8 Moen St.,

Worcester, Mass.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



THE "ILLINOIS" VARIABLE CONDENSER

The Condenser with "Star Spring" Tension
MADE RIGHT - STAYS RIGHT
Hard Rolled Aluminum Plates

These condensers are made by a watch mechanic schooled in accurate workmanship and who can't get over the habit of critical inspection.

Three Styles; No. 1. Panel; No. 2. Open Type as shown; No. 3. Fully Enclosed. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

Style No. 1 No. 2 No. 3	Money back if not satisfied. Just return condenser within 10 days by insured P.P.
67 Plates, \$7.00	\$
48 "	3.50
23 "	2.75
18 "	2.25

With Style No. 1, we will, if desired, furnish 3 inch Dial with large knob, instead of Scale and Pointer.

Extra Price 75 cents.

Sent Prepaid on Receipt of Price.

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c. Foreign Orders other than Canada not solicited.

The "ILLINOIS" is rapidly adding to the number of its friends. The bouquets they fling only spur us to still more careful work, and more rigid inspection. It is a matter of pride that among the thousands of instruments sent out, not a single complaint has been received of bad condition. This may possibly be because every instrument is subjected to the scrutiny of the "old man's" eyeglass.

Patent is pending on the "Star Spring" feature, which is very valuable. The action of this spring produces an unvarying friction that holds the "rotor" in any position to which it may be set, and at the same time automatically centers the plates in relation to each other, and prevents any possibility of "endshake."

The plates are in proper relation by construction, and will remain so, obviating any necessity of re-adjustment. Once right, always right. Once mounted on your panel, there is one thing that you can depend upon to never give you trouble.

We thank our friends for their letters of general appreciation.

Kindly note: We issue no Catalog, and make no "trade discounts". We set our prices at the lowest limit, and leave the "middle man" out for the sole benefit of the "consumer".

G. F. JOHNSON, 625 Black Ave., Springfield, Ill.

TELEGRAPHY

(Both Morse and Wireless and RAILWAY ACCOUNTING taught rapidly and quickly. Big salaries now paid. Great opportunities for advancement. Oldest and largest school; established 45 years. Endorsed by Telegraph, Railway, Radio, and Government officials. Expenses low—opportunities to earn large portion. Catalog free.

DODGE'S INSTITUTE

• Street, Valparaiso, Ind.

Attention Amateurs

G. E. Detector Tubes.....	\$5.00
A. P. Electron Relays.....	6.00
7 Strand Copper Wire, C. ft.	1.25
7 Strand Copper Wire, per 1000 ft.....	10.00
Enamel Wire No. 22, 24, 26, 28 on 1 lb. spools, per lb.....	1.00
Also DeForest, Acme, Amrad, Radiocraft Products.	

The Quaker Light Supply Co.

728 Arch St., Philadelphia, Pa.

Attention of Mr. H. J. Dunbar.

DETROIT

NOW HAS A COMPLETELY STOCKED RADIO SUPPLY HOUSE CARRYING THE FOLLOWING HIGH GRADE LINES:

GREBE — ACME — THORDARSON — MURDOCK — CHELSEA — BENWOOD — TUSKA — FEDERAL — BURGESS, ETC.

MAIL ORDERS SOLICITED.

DETROIT ELECTRIC CO.

434 SHELBY ST., DETROIT, MICH.
ESTAB. 1886. PHONE MAIN 1406.



PATENT-SENSE
"The Book for Inventors & Mfrs."
By Return Mail FREE. Write
LACEY & LACEY, Dept. 9, Washington, D.C.

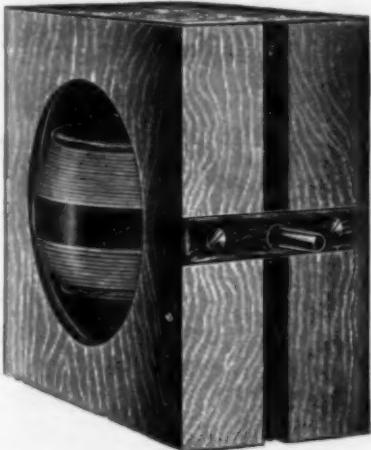
Quality WEACO Service

VT Sockets—\$0.90, \$1.00, \$1.20, \$1.50, \$1.75. New Radiotrons, \$5.00. Electron Relays, \$6.00. Signal Navy Type Reg. Receiver, \$37.50. 6 V. 60-80 amp. storage battery, guaranteed 2 years, \$20.00.

WESTCHESTER RADIO SERVICE
253 So. BROADWAY, YONKERS, N. Y.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

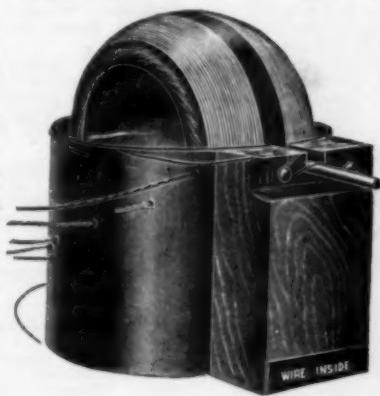
They Have Proved Their Merit— IN NEW YORK CITY AND VICINITY



J J N VARIOMETER — Specially prepared to overcome those loose windings so often found. Dimensions $4\frac{1}{4} \times 4\frac{1}{4} \times 2\frac{1}{2}$. Specify whether $\frac{1}{8}$ or $\frac{1}{4}$ shaft is desired. Price postpaid.. **\$4.50**

Why not try them? Makes a perfectly balanced set with range of 160 to 600 meters.

The feature of the coupler is its inside wound primary.



For sale by New York's leading supply houses and direct from us.

J J N VARIOCOUPLER — With winding that will not come loose inside a non-shrinking, non-warping tube. Brought out to seven taps allowing close tuning. Specify whether $\frac{1}{8}$ or $\frac{1}{4}$ inch shaft is desired. Price postpaid .. **\$5.00**

J. & J. NIGHTINGALE, 741 Market Street, Paterson, N.J.

PRICES ■ S MASHED ■ SLASHED ■ C R I P P L E D —
Murdock sockets 89c; 2000 phones \$3.99; 3000 phones \$4.99; fixed cond. 63c; detector 63c; #366-43 plate var. in case \$4.25; 23 plate in case \$3.39; DeForest LS-100 loud speaker \$31.89; D-101 detector \$2.49; S-200 anti-cap. switch \$2.59; F-200 rheostat 92c; 2 filament Audiotrons \$5.25; A-P Electron Relay \$5.25; Amplifier \$6.25; Transmitter tube \$6.89; A-A amplifying transformer \$3.89; aerial wire, 7 str. tinned \$1.25 C; tested galena 2 for 30c; 6/32, 8/32 brass nuts 9c doz.; knob and lever 2 for 30c; nickelized, insulated B. Posts 10c ea., 95c doz., ORDER FROM AD. \$10 or more F.P. to zone 4. REMIT BY MONEY ORDERS, CERTIFIED CHECKS, Stamps accepted to \$1. ■ AN INTRODUCTORY OFFER. ■ STOCK DEALERS PROTECTED. ■ 20% DISCOUNT on "Hi-Grade" complete panel and receiving outfits, on the 1st 5 orders from each city, of one or more items. Same discount on all types, detectors, amplifiers, tuners, long and short wave VT sets. Prices from \$2 to \$125. Stamp for full list. Terms; cash or 1/3 with order, balance C.O.D.

H I - G R A D E W I R E L E S S I N S T R U M E N T C O , A S H E V I L L E , N . C .

1/4 H. P., 110 volts,
A. C., 60 cycle,
single phase,
1750 R. P. M.
MOTORS
LARGE QUANTITIES NEW WASHING MACHINE MOTORS
These are standard manufacture and carry the full factory guarantee.
Shipped in original boxes. Complete as cut. Suitable for operating Coffee Grinders, Cream Separators, Bottle Washers, Air Compressors, Small Lathes, Etc.
Mail 10.00 cents or Money order
We will send C.O.D. subject to full examination.
Money Back Guarantee.
Manufacturers' DISTRIBUTOR
CHAS. H. JOHNSTON - Box 19 W. E., Pittsburgh, Pa.

\$22.75 Each

NEW ORLEANS RADIO APPARATUS AND SUPPLIES

ROSE RADIO SUPPLY
604 GRAVIER STREET
NEW OLEANS, LA.

Send 10c for Latest Catalogue

"JUPITER"

allows your transmitter energy to radiate from a broad surface of pure copper at a minimum resistance. Seven strands No. 22 solid copper. Strong and flexible. High conductivity plus 100% radiation.

1 1/2c Per Foot—\$12.00 Per Thousand

Shipping weight 15 lbs. per thousand. Send check or money order. No C.O.D.'s. Discount to Clubs, Colleges and A.R.R.L. officials. Immediate delivery.

LEE A. BATES,

8 Moen St.,

Worcester, Mass.

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

CLASSIFIED ADVERTISEMENTS

Five cents per word per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for succeeding month's issue.

WANTED: 1 K.W. United Wireless "Coffin" transformer. Advise all particulars. S. Kruse, 2837 Garfield N.W., Washington, D.C.

FOR SALE—CW units, varicouplers, \$6.00; Variometers, \$5.00; Oak cabinets all sizes, with or without bakelite panels; VT control units, series parallel panel switch, 50; varicouplers are bakelite construction. Meade Bakelite and Radio Apparatus, 975 Putnam Ave., Brooklyn, N.Y.

FOR SALE—Grebe CR-7 and CR-1 receiving sets, both in A-1 condition. Also complete Phone set including motor-generator, power tubes, and storage batteries. Write for particulars. E. H. Arnold, 19 Westland Road, Watertown, Mass.

FOR SALE: \$24.50 Amrad $\frac{1}{2}$ K.W. quench gap, \$18.50-\$27.00 $\frac{1}{2}$ K.W. Thordarson transformer, \$20.50. You pay transportation. Clyde C. Willey, 155 Myrtle St., Manchester, N.H.

RADIO PHONISTS ATTENTION: High voltage generators. We supply motor generator units in various capacities especially designed for radio phone work. Low powered rotary converters, dynamotors, fractional H.P. motors, storage batteries. Various types of meters, condensers, navy type 4" nickel plated brass engraved dials, spark gap rotors, SYNCHRONOUS SPARK GAPS. RAY-DI-CO RADIO PHONE sets furnished knocked down ready for assembling and your connection. Get acquainted with our SERVICE. RAY-DI-CO, 2653D, N. Clark St., Chicago, Ill.

FOR SALE—1 K.W. transmitter, complete \$70.00. Will buy "Tungar" rectifier $\frac{1}{2}$ list price. Barrett, 222 N. Dunn St. Bloomington, Indiana.

EDISON STORAGE BATTERIES—Nickel-Iron Type. 1.2 V. 100 amp. hours \$3.00 per cell; 1.2 V. 150 amp. hours \$4.00 per cell; 1.2 V. 200 amp. hours \$5.00 per cell. Complete with case fully charged. Write for information. No C.O.D. orders. Wireless Shop, 31 East Elm St., Brockton, Mass.

BARGAIN:—1 KW Aull-Zeigler Rotary gap, 110 V. A.C. Universal Motor, One piece machined zinc disc, brass standards with cooling flanges. Henry W. Bartsch, Box 426 Marlborough, New York.

FOR SALE—One Acme $\frac{1}{2}$ K.W. old type. First \$13 gets it. One Murdock Loose Coupler, brand new, \$8. J. M. Hallowell, Jr., Chestnut Hill, Mass.

RADIO PHONISTS ATTENTION—The same as last month, Money Refunded if this Set does not work. A short distance Radio Phone operating on "B" Batteries. The tube can be obtained from the Kehler Radio Labs.—their Ad appears on another page. Enclose One Dollar for Hook-up and directions. H. D. Selvage, 1096 Clinton Ave., Dept. R, Irvington, N.J.

WANTED—Western Electric loud speaker, with or without horn. Albert J. Higson, 84 Romaine Ave., Jersey City, N.J.

FOR SALE: Acme 200 watt mounted CW transformer, \$15. Two Electrodyne Rectifier Tubes \$6.00 each. All new, never used. Precision Equipment Co. "Ace" CW transmitter, complete, \$100. Full description on request. A. C. Hengelbrok, 922 Washington, Newport, Ky.

What am I offered for one Benwood Gap and two VT 1's with burned out filaments. Gap only used one hour. 9BG.

SELL: One KW Amrad Quenched Gap and Resistance for same. Guaranteed good as new. Edwin Moore, 309 Sherman St., Joliet, Illinois.

AERIAL WIRE—No. 12 gauge bare copper wire, 60c per 100 feet; \$2.50 per 500 feet. Add postage. No C.O.D. orders. Wireless Shop, 31 East Elm St., Brockton, Mass.

FOR SALE:—Hamilton Beach Sewing Machine Motor, \$12. Richard Warren, 57 Monmouth St., Brookline, Mass.

FOR SALE—Chemical laboratory complete Radio-Control Panel and amplifier—Others. Send stamp for details and photo. Ingersoll, Buffalo, Minn.

$\frac{1}{4}$ K.W. New Type Thordarson \$12.00; Sayville Rotary 1 K.W. \$10.00; Blitzen Helix $\frac{1}{2}$ K.W. \$3.00; Standard Key \$3.00; Junior Pancake Helix \$1.00; Aerial Switch \$3.00; Oil Condenser 1 K.W. \$5.00; Brandes Headset

\$5.00; Marconi-Victor Wireless Records \$5.00. Russell Flora, Sylvania, Ohio.

SELL—New $\frac{1}{2}$ K.W. Type R Thordarson \$22.00; Meteor key \$4.50. Neither instrument ever used. George Thomas, 118 Hyland, Ames, Iowa.

FOR SALE: One 350 volt DC generator cap. 75 watts \$45.00; Two Weston Milliammeters Type 301 scale 0-100 and 0-500 never used \$15.25; One 0-5 DC ammeter for fil. new \$6.25; Two Western Electric fixed condensers 1 mfd. each \$3.00; One iron core choke \$2.00; One rheo. 11 ohms res. \$1.25; One 65 turn inductance coil, variable \$2.50; Two Hifrequency chokes \$2.75. McCamant C. Higgins, Oldtown, Va., 3HL.

FOR SALE—Murdock rotary in soundproof cabinet, \$14.00; Clapp-Eastham $\frac{1}{2}$ K.W. transformer, \$12.00, A1 condition. Dr. Cyriax, 219 East 71 St., New York City.

SELL— $\frac{1}{2}$ K.W. transformer coil \$6.00, Interrupter \$2.00, Leyden jars 1 pt. 50c each, Double filament Audio-tron never used \$4.50. Galen Baker, Clay City, Indiana.

TRADE OR SELL 3.8 K.W. generator for motor generator, also 2 in. spark coil and electrolytic interrupter. Ralph Hoak, Eaton, Ind.

YOUR CALL ON CARD 25c. R. RUSSKE, 14 Prince- ton St., Rochester, N.Y.

6,000 MILES ON A SINGLE BULB. 175 to 20,000 meters. Simple diagram of a complete short and long wave receiver, both arc and spark, with which we read Honolulu, 6,000 miles, Germany 4,000 miles, San Diego, Calif., British Stations, and practically all the high powered foreign and domestic stations. Amateur and spark stations together with telephone and music come in good. Diagram and complete instructions mailed for 50 cents in coin or stamps. Virginia Novelty Co., Martinsburg, W. Va.

FOR SALE:—2 K.W. Packard Transformer, 4 powers, \$40; 5 Marconi type Leyden jars, \$25. Formerly at 1ZL. Sent express prepaid upon receipt of money order. Henry Eberlein, 95 Sanderson St., Greenfield, Mass.

WANTED— $\frac{1}{2}$ or 1 KW Hightone transmitter. Give description, price, etc. in first letter. Roy Palmer care Barker-Fowler, Lansing, Michigan.

FOR SALE: Perfect, CR-2, Variables, Couplers, etc. W. J. Brigham, 50 Hall Ave., West Somerville, Mass. Phone Somerville 2581-J.

FOR SALE: "Blitzen" $\frac{1}{2}$ K.W. transformer; 110 v. 60 cycle; "Chelsea" rotary gap, enclosed; Robbins and Meyers motor, 110 v. 60 cycle; pancake oscillation transformer; radiation ammeter, 0. to 1.1 amps. transfer switch; "Paragon" RA-6 short wave amplifying receiver; 2 "loose-couplers", 2500 m. 1500 m.; 2 prs. phones, Holzer-Cabot 3000 ohms, Bunnell 2000 ohms; 4 small receiving condensers, 3 variable, .005, .0045, .0005 mfd. Call, write or telephone. J. Dunham, 73 St. Pauls Pl., Brooklyn, N.Y.

SELL—Tron Panel \$9. Navy Coupler \$13. 3000 ohm Murdock \$5. Gelenia Receiving Outfit \$5. Complete 1 in. Coil Transmitter \$12. Johns. Radio 9AQ-B. Mulvane, Kansas.

FOR SALE: DeForest combination Audion-Ultra Audion and one step amplifier, P-300. Practically new, a bargain. First \$50.00 check gets it. Dr. Ernest Bulluck, Wilmington, North Carolina.

FOR SALE: 100 amp. ground switch \$4.00. Two honeycomb coils L-250 at \$2.00 each, key \$1.00. S.P.S.T. knife switch 25c. Murdock phones No. A55 \$4.50. Graphite potentiometer \$3.00, variometer \$5.00. C.W. apparatus for transmitting. Grid leak \$1.00, Hot wire meter \$7.00. Audiotron double filament \$6.00. Adapter \$1.75. Will take off 25% for cash. Alvin R. Lavitt, 13 Grant St., Natick, Mass.

TELEGRAPHY—(both Morse and Wireless) and Railway Accounting taught quickly. Tremendous demand. Big salaries. Great opportunities. Oldest and largest school; established 45 years. All expenses low—can earn large part. Catalog free. Dodge's Institute, R St., Valparaiso, Indiana.

FOR SALE— $\frac{1}{2}$ Acme—Marconi .007 Cond.—Comm. O.T. all \$40. 1 KW. 110 A.C. Rotary Gap \$40. H.P. Emerson 110 A.C. Motor 5 V. 6 A. Generator \$10. Tungar Rectifier 12 V. 10 A. capacity—Electron Relays and Audiotrons \$5 each. 6 V. 200 A.-H. Storage (Glass Jars 6x12x15 3 cell) \$30. French Equipment—Intervalve Transformers \$15 each; .0005 Var. Conds. \$15 each; 3000 ohm phones \$10. Lots of other apparatus—Send for list. R. S. Jackson, 391 Greenwich Ave., New Haven, Conn.



Clear as a Bell

The New Bell Rotary Quenched Spark Gap



ADVANTAGES OF THE "BELL" ROTARY GAP

- 1—Special Aluminum Alloy casting.
- 2—Small hysteresis loss.
- 3—Low decrement.

- 4—Short leads.
- 5—Balanced Rotor.
- 6—Four Adjustable Electrodes.
- 7—Glass windows for easy adjustment.
- 8—Hardened and ground shaft.
- 9—Bronze Bearings.
- 10—Oil Ring Lubrication.

Write us direct or order from your nearest dealer.

When ordering, state whether 6, 8, or 12 electrodes are desired. We can furnish special rotors with the gap, for which an extra charge will be made.

Price \$55.00 F.O.B. Indianapolis



The Electric Machine Co

"PW" Has The Latest Radio Apparatus In Philadelphia

Come in and see Us—You do not have to Buy.

We have complete stock of parts for the Radiophone you are building.

Philadelphia School of Wireless Telegraphy

10th Floor, Parkway Building, Broad Street, Near Arch, Philadelphia

BARGAINS—Prize winning set in Jan. 1920 R.A.N. \$60. Short wave regenerative receiver \$20. Both A1 condition. Urban Worner, 1052 City Park Ave., New Orleans.

FOR SALE.—Omnigraph, 15 dial, perfect condition, \$15. Multiaudifone, \$10. C.R.L. Paragon & Amplifigon Agen 1, used very little, \$95.00. 3 inch Induction Coil, like new, \$15. Murdock Oscillation Transformer, new, \$4. Honeycomb Coil Mounting (base) & 12 Coils ranging from 600 to 25000 meters,—almost new—\$28. Two Amplifying Transformers, C.R.L. type, \$3.00 each. V. J. Coughenour, Plattsburg, Ohio.

FOR SALE—A set of mounted and tapped honeycomb coils 200-20000 meters. J. A. Messier, 28 Quincy St., Quincy, Mass.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

JUST OFF THE PRESS RADIO TELEPHONE

Simple description of the Radio Telephone with complete circuits of a Transmitter, Receiver and Amplifier. With this data anyone can construct a Radio Telephone capable of talking fifty miles. The Amplifier used with a loud speaker intensifies the voice very clearly. 25 cents postpaid.

FOREST PUBLISHING CO.
No. 19 Myrtle Street, Boston, Mass.

SHORT WAVE COUPLER

—170-625 Meters—

Wound with 20/38 Litz on Bakelite Tubing. Equipped with DeForest 1½" Knob, Brass Points and Scale. Used by U. S. Government in SCR-54 Receiver.

PRICE \$4.50 UNMOUNTED

GOUSE & LORENSON
HUDSON, N. Y.



THE CONDENSER WITH A BACKBONE

Our new variable air condenser (.0007 M.F.) is ready for the market—for you. It is built—not assembled—with a rigid aluminum casting for a foundation. The plates are of .032 half hard aluminum sheet. The entering edge of the rotary plates is rounded off so that the calibration curve is practically straight. This condenser has but one bearing, of spring controlled double-cone type, which insures smooth, uniform rotation and also automatically takes care of any wear. This condenser can be mounted in either horizontal or vertical position.

Price Unmounted as shown \$5.00

We also have in stock for immediate shipment 20/38 S.C.C. Litz.

Price per 100 ft. \$0.40

The above articles shipped postpaid upon receipt of remittance. To avoid delay or possible loss, remit by Postal Money Order.

COTO-COIL CO.

**87 WILLARD AVE.,
PROVIDENCE, R. I.**

TIGHTLY BOUND

—FOR YOUR CONVENIENCE—

QST'S INDEX OF ADVERTISERS IN THIS ISSUE

Acme Apparatus Co.	70	Lacey & Lacey	114
All-American Electrical Mfrs.	110	Massachusetts Radio & Tel. School	82
American Electro Technical App. Co.	84	McMahon Radio Supply Co.	108
American Radio & Research Corp.	Fourth Cover	Metal Arts Co.	102
American Radio Sales & Service Co.	102	Meyberg Co., Leo J.	102
Atlantic Radio Co.	Second Cover	Midwest Radio Co.	82
Atlantic Radio Supplies Co.	91	Montgomery-Ward & Co.	62 to 67
Audiotron Mfg. Co.	120	Murdock Co., Wm. J.	109
Bates, Lee A.	115	Mutual Purchasers Assn.	71
Benwood Co., Inc., The	81	National Radio Institute	85
Brndes, C., Inc.	78	Newman-Stern Co., The	102
Bunnell & Co., J. H.	76	Nightingale, J. & J.	115
Burgess Battery Co.	74	Northern Radio Laboratory, The	90
C & S Radio-Electric Co.	101	Oregon Inst. of Technology	94
California Elec. Supply Co.	96	P & M Radio Co., The	100
Central Radio Co.	111	Pacent Electric Co., Inc.	2
Central Radio School	111	Pacific Radio Pub. Co.	92
Chelsea Radio Co.	84	Pacific Radio Supplies Co.	91
Chicago Radio Laboratory	1	Paquin, J. M.	110
Clapp-Eastham Co.	103	Parkin Mfg. Co.	112
Connecticut Tel. & Elec. Co.	Third Cover	Philadelphia School of Wireless Tel.	117
Continental Radio & Elec. Corp.	60-61	Pitts Co., F. D.	87
Corwin & Co., A. H.	99	Precision Equipment Co., The	92
Cosradio Co.	112	Quaker Light Supply Co.	114
Coto-Coil Co.	118	Radio Corporation of America	97
Craig Mfg. Co.	100	Radio-Craft Co., Inc.	105
Crescent City Radio Co.	100	Radio Distributing Co.	73
DeForest Radio Tel. & Tel. Co.	111	Radio Electric Co.	72
Detroit Electric Co.	114	Radio Equipment Co., Boston	72
Detroit Radio Laboratories, Inc.	110	Radio Equipment Co., Phila.	80
Dodge's Institute	114	Radioelectric Shop	86
Doolittle Co., F. M.	76	Radio Shop, The	113
Doubleday-Hill Electric Co.	113	Radio Telephone Shop, The	92
Duck Co., The Wm. B.	72	Radio Testing Station	88
Eastern Radio Co., The	90	Ray-Di-Co.	76
Eastern Radio Electric Co.	108	Reynolds Radio Specialty Co.	108
Eastern Radio Institute	89	Rhamstine	107
Evansville Radio Laboratory	88	Richter-Schottler Co.	74
Economy Radio Supplies Co.	110	Rose Radio Supply	115
Electrical Specialty Co.	93	Shotton Radio Mfg. Co., The	76-77
Electric Machine Co., The	117	Skinderviken, J.	75
Experimenters Information Service	95	Somerville Radio Laboratory	82
Federal Tel. & Tel. Co.	106	T & H Radio Co.	96
Firth & Co., John	80	Taylor Co., The	107
Forest Pub. Co.	117	Thordarson Elec. Mfg. Co.	98
France Mfg. Co., The	104	Tresco	88
General Radio Co.	94	Turney Laboratories, Eugene T.	75
Gouse & Lorenson	117	Tuska Co., The C. D.	79
Grebe & Co., A. H.	83	Uttmark's Nautical Academy	104
Gustafson Bros.	106	Westchester Radio Service	114
Haake, Arthur	86	Western Radio Electric Co.	84
Hamilton, F. F.	110	Whittall Electric Co.	98
Harrison & Dudley	86	Wireless Improvement Co.	94
Hi-Grade Wireless Instrument Co.	115	Wireless Mfg. Co.	74
Johnston, Chas. H.	115	Wireless Shop, The	107
Johnson, G. F.	114		
Karlow Radio Corp., The	90		
Kehler Radio Laboratories, The	80		
Kelly & Phillips	98		
Kennedy Co., The Collin B.	104		
Keystone Wire Co.	96		
Klaus Radio Co.	106		
Koch, John R.	112		

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



Detector Type

WITH STANDARD



Tube C-300

FOUR PRONG BASE

TYPE C-300 invites comparison. Amateur requirements decided its design. Many years research of vacuum tube properties have made Type C-300 the Ideal Amateur Receiving Tube. Detector sensitiveness at low plate voltages requires that gas action be combined with the electron emission and by a wonderful new process of manufacture this gas action is so controlled that the plate voltage for maximum signal audibility is always within the limits 18-22½ volts. Only a single block cell is needed in the plate circuit—a big saving in battery investment. Type C-300 is completely silent in operation—a decided advantage in receiving weak signals.

Any three member vacuum tube is necessarily an amplifier but the results obtained from Type C-300 as a tone frequency amplifier with only 22½ volt plate battery proved a surprise. Again Type C-300 invites comparison. Competitive tests show this tube to excell any tone frequency amplifier previously developed. For power amplification in operating loud speaking telephones and in complex and multistage circuits use the special Pliotron amplifier Type C-301 for freedom from distortion. Write for special Bulletin C-301.

Type C-300 is a free
for regenerative am-
reception.

TYPE C-300

\$5.00

and persistent oscillator
plification and C.W.

The pleasure and satis-
faction from operating
Type C-300 cannot be described. See your dealer today—or write
for his name and copy of Bulletin C-300.

TRADING AS
AUDIOTRON MFG. COMPANY

35 MONTGOMERY STREET,

SAN FRANCISCO

120

ALWAYS MENTION QST WHEN WRITING TO ADVERTISER

O
ERTISE